SCIENTIFIC AMERICAN

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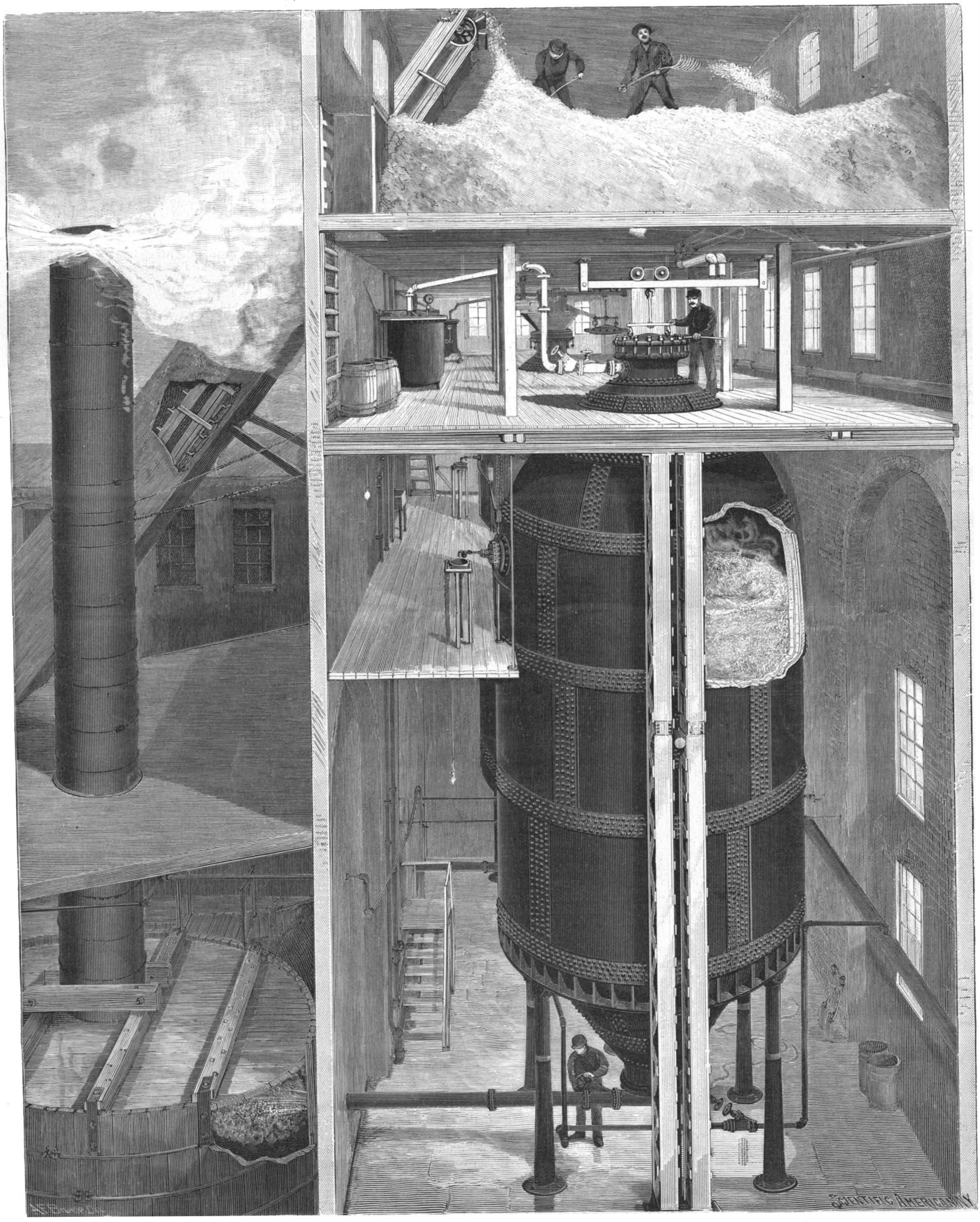

THE MANUFACTURE OF PAPER—I. PREPARATION OF WOOD PULP BY THE SULPHITE PROCESS.—SECTIONAL VIEW SHOWING BIN FOR WOOD CHIPS AND THE MAMMOTH SULPHITE DIGESTERS.—[See page 185.]

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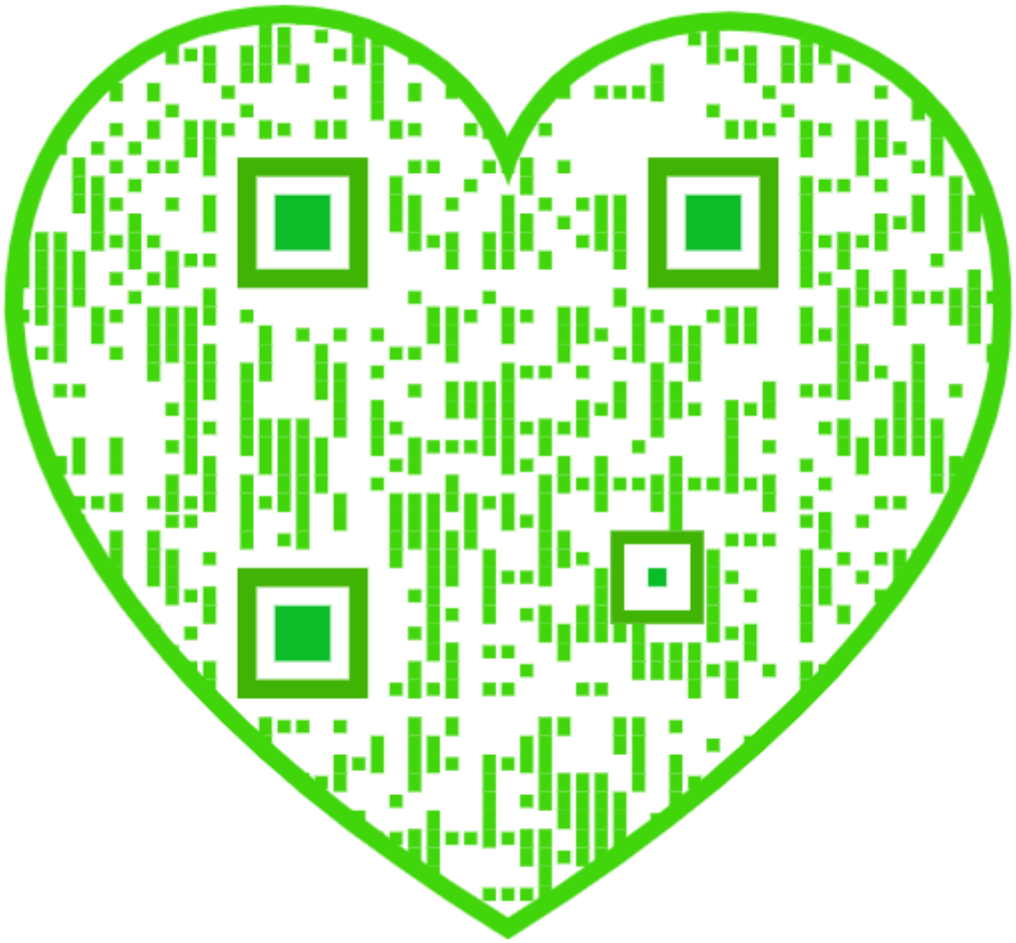

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WAR MEASURES THAT MAKE FOR PEACE.

The extreme tension of the past few days in our foreign relations has undoubtedly been greatly relaxed by the action of Congress in appropriating, unanimously and practically without debate, the sum of $50,000,000 for the purpose of national defense. While the extraordinary activity in our dockyards and arsenals and the voting of this vast sum for naval and military expenditure have all the appearance of preparations for war, it is well understood that they are in reality the very best guarantee that peace will be preserved.

Although the Court of Inquiry on the "Maine" disaster has not yet reported, there is a growing impression that the loss of the ship was not accidental. At the same time it is doubtful if anyone, outside of that section of the press (happily very small) which would criminally drag the country into war, believes for a moment that if the ship was deliberately wrecked the Spanish government was in any way concerned in such an unspeakable crime. Self-interest alone would prevent a government from commencing hostilities by an act which would bring down upon it the execration of the whole civilized world.

The administration is for peace, if peace can be preserved consistently with the rights of all the parties concerned in the present crisis. It is admitted on all hands that the President has acted with the moderation, dignity and self-restraint that become the representative of a nation of our wealth and power. The vote of $50,000,000, moreover, is not in any sense a reversal of our policy of peace. It is simply a concrete evidence of the fact that our pacific attitude is not to be mistaken for pusillanimity, and that we can afford to be calm under circumstances of extreme aggravation because we are sure of our strength and sure of the integrity of our purpose.

The defense fund is to be used in thoroughly equipping the army and navy, in strengthening the fortifications and possibly in the purchase of ships which are completed or nearing completion in foreign shipyards. If a conflict should occur, it would largely be confined to the sea, and while our navy is undoubtedly stronger than that of Spain, the difference is not so great but the purchase by Spain of the warships nearing completion in European yards might make matters even, if it did not give the Spanish navy a slight preponderance. It was reported that negotiations were under way for the transfer of several powerful ships to Spain; but it is now reported that the English government has prohibited the sale of these vessels to either country—the alleged reason being that she may require them for her own pressing needs.

In order to render available to the full our own preponderance of naval strength every ship is being placed in commission. An enlistment board has been named which is enlisting some 2,000 additional seamen, and plans have been completed for commissioning our fast merchantmen, such as the "St. Louis" and "St. Paul," as auxiliary cruisers. The warships to be newly placed in commission include the commerce destroyers "Minneapolis" and "Columbia," monitors like the "Miantonomoh" and "Terror," and the ram "Katahdin," and, possibly, the old monitors which remain on the list as a legacy of the late war. Full supplies of shell and ammunition are being manufactured and forwarded to the sea coast fortifications, and both the private and government factories are working to their utmost capacity to provide guns and mounts for our uncompleted batteries.

Meanwhile our various fleets are being concentrated at strategic points—the Atlantic fleet in the neighborhood of Cuba, the Pacific fleet at Hong-Kong, and our ships on the European station within striking distance of Spain. In the event of hostilities—which we consider to be very unlikely—the chief fighting ground would be in the West Indies and more particularly in Cuban waters, where Spain would soon be at enormous disadvantage through the difficulty of securing adequate coal supplies. This fact alone renders a resort to war on the part of that country a very remote possibility; for unless the chances of war should greatly favor her, it is difficult to regard such a conflict as being anything better than a forlorn hope.

Whether matters are pushed to the last extremity or not, it is certain that Congress has realized the necessity of keeping the defenses of the country up to the state of efficiency which its naval and military advisers have so long and so vainly recommended.

THE BRUSSELS CONFERENCE OF THE INTERNATIONAL UNION FOR THE PROTECTION OF INDUSTRIAL PROPERTY.

From December 1 to 14, 1897, representatives of the countries belonging to the International Union for the Protection of Industrial Property met in conference at Brussels, Belgium, to discuss the advisability of changes in the provisions of the convention concluded at Paris on March 20, 1883.

This convention (to which the United States adhered in 1887) had for its object to secure to subjects or citizens of the contracting states reciprocal privileges in regard to the protection of inventions, designs and trade marks: also for suppressing fraud in the designation of the origin of goods.

One of the most important sections of the Paris convention is that which allows citizens or subjects of any of the contracting parties a right of priority during a predetermined period after the filing of an application for a patent, design or trade mark in one of the states of the International Union. In relations between the United States and the European countries belonging to the union this period amounts to seven months so far as patents are concerned and to four months as regards the registration of trade marks. Thus, a person who files an application for a United States patent on April 1, 1898, will, if he applies for a British patent under the International Convention on or before November 1, 1898, secure the same rights in the United Kingdom as if the application had been lodged there also on April 1.

The Brussels conference has adopted a series of amendments to be submitted for approval and ratification to the respective governments.

The first amendment extends the privileges of the convention to the subjects or citizens of states not belonging to the International Union, provided that they are residents of one of the countries of said union, or have bona fide industrial or commercial establishments in such a country.

Another amendment has been proposed to make it appear more clearly than in the original wording that public use of the invention by the inventor, after he has filed his application in one of the contracting states, shall not invalidate his claim to a patent in any country in which he files an application in conformity with the convention.

The most important amendment is one declaring that patents obtained in countries belonging to the union, by persons entitled to the benefits of the convention, shall, in their term or duration, be entirely independent of any patent obtained for the same invention in any other country, whether this latter country be a member of the union or not. This amendment is very similar to that recently made to the United States patent law, and will, if adopted, do away with the limiting provision still found in the patent laws of many countries (for instance, France), that the domestic patent shall terminate with the expiration of any prior foreign patent. The same amendment further specifies that its provisions shall apply to all patents existing at the time of its adoption, and, in case of accessions to the International Union, the newly received state shall adopt the same practice in regard to its own patents and those in other countries of the union, so far as such patents exist at the time of the accession.

As to inventions, designs or trade marks used or exhibited at official or officially recognized international expositions held in one of the countries belonging to the union, such inventions, designs or trade marks shall receive temporary protection in *all* the countries of the union, in accordance with the legislation of each country.

For the protection of trade marks and trade names, it is proposed that in countries where the law does not permit of the seizure of goods bearing such marks or names unlawfully, a prohibition of importation may take the place of the seizure. Goods in transit need not be treated according to this section of the convention.

Furthermore, goods will be liable to seizure or to be prohibited from importation in the countries of the International Union if they bear, as a fraudulent indication of origin, the name of a well defined locality, provided said name is used together with a fictitious trade name, or with one borrowed with fraudulent intention. A suit under this section may be brought by any party engaged in the production or sale of the goods, and having his establishment either in the locality wrongfully designated as place of origin of the goods, or in the region (section of the country) in which such locality is situated.

In regard to the manner in which these amendments are to be adopted by the countries belonging to the International Union, and with reference to admission of other states to the union, and to the time when said amendments shall be and remain in force, the following conditions have been agreed upon:

The governments of the countries comprising the union are invited to sign the amendment within six months from December 14, 1897; said governments shall ratify the amendments, and forward the ratifications to Brussels for exchange as soon as possible, and not later than within one year. The amendments shall be effective three months after the exchange of the ratifications, and shall remain in force as long as the original convention of March 20, 1883 (subject to modification and cancellation at later conferences). The convention shall be revised periodically, by conferences to be held in one of the contracting states. Countries desiring to be received into the International Union shall inform the Swiss government by their diplomatic representatives, and this government will give notice to the other countries of the union. The accession will become effective one month after the Swiss government will have forwarded the above men-

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tioned notices, unless the state applying for admission shall have named a later date.

The result of the Brussels conference, short as its sessions have been, is very important. Many amendments have been proposed in addition to those we have reviewed, but owing to lack of time no decision has been reached in regard to them. Another conference will therefore probably be held this year.

It is certainly in the interest of American inventors and American owners of foreign patents that the proposed amendments should be ratified by the United States. The privilege of having a foreign patent in a country of the union absolutely independent of patents in any other country will alone be extremely valuable in many cases. The provisions concerning trade marks will also be welcome to American manufacturers, especially in view of the tendency abroad to increase the sale of goods by fraudulently creating the impression that they are of American origin.

It is to be regretted that Germany, Austria-Hungary and Russia should keep aloof from this International Union, of which nearly every important civilized country of the globe is now a member. The accession of the four countries above named is eminently desirable in their own interest as well as that of the present members of the union.

THE NEW SINGLE FORGED CANNON.

The successful tests which have just been completed of the Hobbs single-forged gun, an account of which was given in our issue of February 12, are very gratifying in view of the necessity which exists for the rapid production of war material. The demand just now is for guns of the smaller sizes, such as the 4-inch, 5-inch and 6-inch, and it is in these sizes that the new system of construction will find its most useful application. The test to which the gun was subjected at Sandy Hook was a severe one, 100 rounds being fired, 5 of them with extremely heavy charges. The service charges gave a muzzle velocity of 2,700 feet a second, as against from 2,000 to 2,300 feet a second for the service 5 inch gun. The pressure in the chamber of the gun was 35,000 pounds to the square inch, and with the five heavier charges the chamber pressure rose to 49,000 pounds. This was endured without the least signs of failure.

The great value of the gun lies in the fact that it can be turned out in great numbers in a relatively short space of time. The forging is made in one piece, the necessary initial tension being obtained by cooling from the inside. The saving of time by this process over the old method of construction by shrinking on successive hoops is obvious. If matters should come to the worst, this gun must prove a valuable and opportune aid in the rapid fitting out of armed merchantmen for naval service.

THE REVERSING STEAM TURBINE.

It will be remembered by those of our readers who have been interested in the performance of the "Turbinia" that the turbines with which it was fitted were not capable of reversing. This has been recognized as a serious defect in a motor which seems destined to have its most successful application and its largest field of usefulness in marine propulsion. For entering or leaving dock, for coming to an anchorage, making landings, and in the emergency of a collision, it is absolutely essential to a perfect marine motor that it shall be capable of instantaneous reversing. This the Parsons turbine could not do, and in order to remedy the defect the inventor installed a separate motor which was used to drive the boat astern. This was recognized as being a mere makeshift; for not only was the power of the "go astern" motor limited, but when the boat was in normal operation it constituted a serious dead weight to be carried for which there was no return. Moreover, for effective torpedo boat work it is absolutely necessary that the whole horse power of the engines shall be available for going astern at the moment of attack, if necessity should call for it.

Mr. Parsons was well aware of the defect, and after considerable experimental work has succeeded in producing a motor which will reverse, and secure almost as great a propeller thrust in going astern as when going ahead. The means by which this has been done are simple and ingenious. By means of butterfly valves and an alteration of the configuration of the blades it is possible to change the direction of the flow of the steam through the turbine. The valves are located at the points where the steam pipes connect with the steam passages, corresponding to the positions occupied by the steam chests in the simple or compound engines of the reciprocating type. The steam passes a butterfly valve and enters the cylinder at one end, passes through it and then returns to the opposite side of the valve. Here it is free to pass to the exhaust or to the condenser, according as the turbine is a simple high pressure or a condensing machine. In the case of a compound or a triple expansion turbine the steam would pass to the low pressure or the intermediate cylinder as the case might be.

The butterfly valves above each cylinder are connected by levers and may be simultaneously reversed by means of a single reversing lever. In the reverse position the steam is introduced at the opposite ends of the cylinders and travels through them in the reverse direction. In going ahead the steam strikes upon the concave surface of the blades, in going astern it encounters their convex surfaces. It is evident that in the latter case the full efficiency of the turbine will not be realized, and to remedy this the inventors have designed a turbine with straight blades which have opposite convexities formed at the opposite edges of the blades, the object of which is to insure that the steam shall impinge on a concavity whether the motor is running in both the "go ahead" and "go astern" directions. By this means it is expected that an equal efficiency will be obtained in each direction.

We are of the opinion that the proposed blade will not prove so economical as that presenting a curved surface to the steam, and that in departing from the accepted type of turbine blade Mr. Parsons is sacrificing the efficiency of the motor in its normal operation. While it is obviously necessary that a marine motor should be able to reverse, it is not by any means clear that it must necessarily be able to develop as much power on the propeller when going astern as it does when going ahead. It is sufficient that a boat should be able to go astern at a fair rate of speed, and this is what the motor with curved blades would probably do, in spite of the fact that the steam was impinging on the convex side of the blades. We question the expediency of reducing the efficiency of the motors in their normal conditions of operation for the sake of securing equal efficiency under reversing conditions which will only occasionally be called for.

The detailed drawings and description of the new motor will be found in the SCIENTIFIC AMERICAN SUPPLEMENT of March 12, 1898, to which the reader is referred for a further study of this interesting subject.

VALUABLE ADVICE TO CATTLE SHIPPERS.

In the preparation of the quarterly report of the Kansas Board of Agriculture, devoted to "The Beef Steer," Secretary F. D. Coburn aimed to not only secure the views of those who are masters in beef production, but also avail himself of observations by others, among them those who deal with the stock when it reaches the market. None have a keener eye for the merits and defects of the beef animal, both as to his individual quality, condition and the treatment given him at home and on his way to market, than the salesmen who receive, care for and sell him to the slaughterer or shipper. From the counsel given by one of the most extensive live stock commission firms, the following excellent advice for every feeder and shipper is given, and is the result of very extensive experience and wide observation. They say: In the first place, a large majority of the feeders make a mistake in holding fat cattle that are ready for market; for instance, a man is feeding 100 to 150 head of steers, and there are, say, one-half or two-thirds of the cattle that are fat and could be shipped at any time. Very few men will ship them out, for the simple reason that all their cattle are not ready, and they hold on to the good ones until the entire bunch is ready. We are continually advising our customers to ship out all fat cattle as fast as ready. By doing so they divide their risk. The cattle that are left have a better chance to improve, and there is more profit to be made in this way on account of the small margin there is in keeping matured steers, as this class of cattle make little gain compared with half-fat steers. Another mistake that is made is in shipping cattle off grass. We have had a number of instances where our customers have shipped cattle that were fed on the grass without putting them in a dry lot for a day or two before shipment and feeding nothing but corn, oats and hay, and, by not doing so, the cattle on arrival look grassy, their hair looks shiny, they shrink almost double what they would if handled in the proper way, and they don't sell within 10 to 15 cents per hundred (and in some cases more) of cattle that are put in a dry lot and fed nothing but corn, hay and oats for a short time before shipment. Overloading is a very bad feature, but we might add that we are not troubled as much in this respect as we were before the charge of freight by cents per 100 pounds became established. A little advice on this subject is still quite necessary, as we have customers frequently who overload their cattle, and, as a result, they make an extra shrinkage; they do not look as well at market, which, as you are aware, affects the sale fully 10 cents per hundred pounds; this means a direct loss to the shipper of 10 cents per hundred, and the extra shrinkage, which is quite a large item, that could be saved with proper management.

The best investment a shipper ever made was in putting extra good bedding in his cars. This is a point which should be well looked after, as it means a big saving from loss of possibly dead or crippled cattle, as well as the shrinkage. We think another point that could be well covered would be, where parties are shipping stock, to classify it as much as possible. In this way the cars are more evenly loaded, the stock ships better and it also saves considerable delay upon arrival here. The work of sorting and shaping stock at this end is a very small item, but, by classifying the stock in the country, it means economy of time at the market. Cattle handle better if they do not get too much water just before shipment. The golden rule in shipping all kinds of cattle is to get them as quickly as possible from range, ranch, farm or feed yard to market. Notably is this the case with rangers. It has been proved time and again that a range bullock shrinks every hour after he leaves his native haunts. It stands to reason that all cattle will do so, but natives do not fret, nor are they liable to get so bruised as the former.

Grass cattle, as a rule, do not ship well. On the pasture they look well, and many a buyer has been deceived by the appearance of a drove of steers in a grass field with full bite. To ship such cattle is a hard task, and is invariably disappointing, but it has to be done. Where convenient, it is a good plan to place such cattle in a pen and feed them hay for a day or two. The secret of shipping all classes of cattle is to place them on the cars full of feed, but with as little moisture as possible. If you ship a steer full of water, he is apt to have loose bowels and show up in the yards badly. Properly handled cattle should arrive in the sale pens dry behind and ready for a good fill of water; not over-thirsty, but in good condition to water freely. Many of our shippers think that by salting their cattle, or by feeding them oats, or by other scheming, they can fool the buyers. This is nonsense. The buyers are just as sharp as the owners, and while many of them say nothing, you often see them ride into a pen and out again without the courtesy of a bid on this account. Dozens of times we have seen this happen. It always acts against the shipper to use unnatural means. To eastern buyers it is a matter of great importance that cattle should be in good condition when purchased, so as to stand further shipment. When cattle drink too freely, they are apt to founder and break down. In this condition the dressed beef men can use them, but it stops competition, and as a natural consequence cattle often go below their value when in this condition.

The same rule applies to grain-fed cattle, whether in pasture or dry lot, as to the above. Only they are much more easily handled in shipment and do not show much distress in their changed circumstances. As to feed on the road, nothing equals good, sweet hay. It beats corn or other grains, because it is easily digested and does not fever the animals. Simple methods and simple feed are the best that can be used. As to water on the road, it is a matter to be decided on according to the weather. In midsummer care must be taken to supply animal wants, whereas in winter a steer can go for many hours without a drink. Good management in this line also calls for the arrival of stock at the yards in proper time. From 5 to 8 A. M. is the best time in the day to appear upon the scene—the nearer the latter hour the better—for cattle especially always look better when they are taken off the cars and have just been fed and watered. Then they have a bloom upon them which wears off very quickly.

Many feeders would be saved both disappointment and loss if, before sending in cattle to market, they would notify their commission house what and when they are going to ship. Then, if the commission merchant thinks the stock would be benefited by longer feeding, or that the prospect is unfavorable for the time the feeder expected to have his cattle in, he can so advise his client, and thus save him from sacrificing his stock or getting in at a wrong time. Especially is this important in November or the beginning of winter, when we are getting half-fat cattle that ought to have been held back thirty to sixty days longer at least. No doubt many of these look all right in the feed lot and appear to have good finish, but not having matured or ripened, they practically "go to pieces" on the cars, and in addition to loss through heavy shrinkage the owner has to accept a low price on the market. We wish every stockman would follow out this plan of giving notice a day or so ahead of the time he expects to ship. It works to the advantage of both the shipper and seller. The latter, being on the market every day, knows just what the market wants, and can judge pretty closely of near prospects. He is thus able to give his client the necessary advice and information he should have before he sends in his stock.

THE NEW DIRECTOR OF THE LICK OBSERVATORY.

At the meeting of the Regents of the State University of California, Prof. James E. Keeler, now at the Allegheny Observatory, was elected director of the Lick Observatory to succeed Prof. E. S. Holden, who recently resigned after twenty-five years of service. Prof. Keeler was educated at the Johns Hopkins University, and has made a great specialty of spectroscopic work. His most famous discovery was that the rings of Saturn were composed of small satellites. He recently delivered the address at the opening of the Yerkes Observatory. The gentlemen who were placed in nomination with him for the directorship were Prof. George Davidson, who is well known for his long connection with the Coast and Geodetic Survey, and Prof. M. Schaerberle, acting director at Mount Hamilton.

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A LAWN MOWER ATTACHMENT.

The illustration represents a construction whereby the cut grass will be taken from the knives of a lawn mower and delivered to a receiving receptacle at the back of the machine, provision being made to prevent the grass being scattered by the wind. The improvement has been patented by Charles E. Kreider, and is being placed before the public by the Kreider Lawn Grass Elevator Company, of Logansport, Ind. Back

KREIDER'S LAWN MOWER ATTACHMENT.

of the ground wheels is located an elevator whose side pieces extend down quite close to the ground, a projecting board or apron coming near the knives, and there being journaled in the side pieces an upper and a lower roller carrying a light but strong endless elevator belt. The elevator is driven by a belt connecting the shaft of the rear ground wheel with a pulley on the trunnion of the upper roller. The elevator has an adjustable cover, to prevent the scattering of the grass, and fenders prevent the falling of the grass between the front roller and elevator. The elevator and basket may be readily attached to and removed from any lawn mower.

HOW FLAG STICKS ARE MADE.

A machine just invented for the quantitative manufacture of flag sticks is represented in the accompanying illustration, and is a direct result of the patriotic impulse which approves of placing the American flag in the hands of every school child, and the general display of the flag on every public occasion. The little sticks to which the flags are attached are consequently in great demand, and by the old method of manufacture they could not be economically supplied in sufficient quantity. Under the old method each stick was rounded separately and the operation was very tedious and slow. By means of this invention the whole board is fed into the machine, the boards being first sawed into the length of the finished stick. J. A. Fay & Company, of Cincinnati, manufacture this machine. There are two sets of cutters, one cutting on the top and the other on the bottom of the board. These cutters are specially shaped, the upper cutter cutting one-half the circle of the finished stick, the lower cutter cutting the other half, and this is done so nicely that when the board has passed the cutters it is cut into finished round sticks, each separate from the other, and each so nicely rounded that the meeting point of the two sets of cutters cannot be observed. After leaving the machine the finished sticks drop into a large box or hopper and are then stacked up ready for the flags. The machine is made so that it will cut any size of stick from the very smallest up to any diameter desired by simply changing the cutters on the cutting mandrel. The arrangement is such that the cutters can be moved from the mandrels very readily and new cutters put in place in about a minute's time. The upper and lower cutters are placed in an almost vertical plane so that they will cut the sticks at almost the same time, and after the sticks leave the cutter they are fed into circular grooves before they leave the machine, so that each separate stick is held firmly in place and a smooth cut assured. The machine cuts the sticks so smoothly and uniformly that sanding is not necessary. This machine can also be used for making all kinds of circular sticks for other uses.

A BALTIMORE judge has decided that faith cure doctors are not entitled to remuneration for their services. He takes the ground that the faith cure physician renders no apparent service to the sick.

Toads at Dinner.

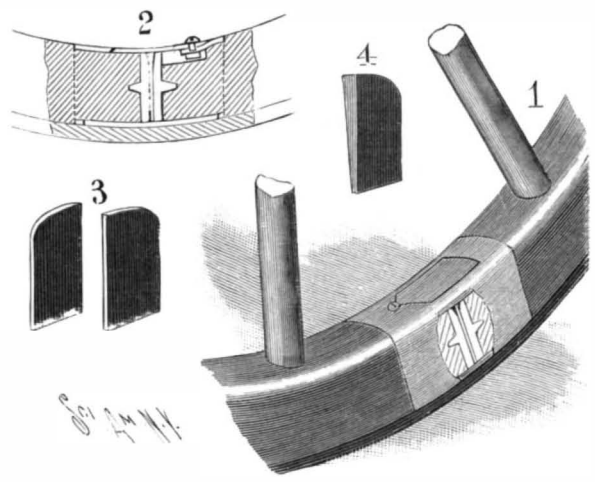
The toad does not take dead or motionless food, says The Popular Science Monthly. Only living and moving insects, centipeds, etc., are devoured, while worms or other larvæ disturbed by their hopping are safe so long as they remain curled up; but as soon as they move they are captured. The toad's tongue, its only organ for seizing food, is soft, extensile, attached in front but free behind, and is covered with a glutinous substance that adheres firmly to the food seized. So rapid is the motion of this weapon that a careful watch is necessary in order to see the animal feed. At night, soon after sunset or even before on cool evenings, the toad emerges from its shelter and slowly hops about in search of food. Something of a regular beat is covered by these animals, whose sense of locality is strong. In the country this beat includes forage along the roadside, into gardens and cultivated fields, and wherever insect food is abundant and grass or other thick herbage does not interfere with getting about. In cities and suburban villages the lawns, walks and spots beneath the electric lamps are favorite hunting grounds. At Amherst, Mass., Mr. A. H. Kirkland, from whose paper we derive these observations, once counted eight large, well fed toads seated under an arc light and actively engaged in devouring the insects which, deprived of wings, fell from the lamp above. At Malden, Mass., a colony of about half a dozen toads sally forth on summer evenings from under the piazza of a citizen's house, go down the walk, cross the street, and take up their stations under the arc lamp, where they feed upon the fallen insects till the current is turned off, when they return to their accustomed shelter.

Japanese Mushrooms.

Mr. Robert P. Porter, who has been conducting investigations into the industries of Japan, states that one of the most interesting studies in that country is the growing of mushrooms in the Shikoku Island, where most of the camphor is produced. This is an important article of export, mostly to China, and during the year 1895, the last year for which the returns are available, the quantity of mushrooms exported from Japan to all countries amounted to 1,780,597 pounds. Of the numerous species of edible mushrooms, the one called Shütake is the most important, being abundantly exported abroad and also used for many culinary purposes at home. Logs which are used for cultivating this mushroom are various species of oak. The principal districts where this mushroom is produced are the provinces forming Shikoku, Kiushiu, Wakayama and Shiozuka prefectures. Oak trees twenty-five to thirty-three years old are felled in the autumn, and incisions made with axes at intervals of three or four inches, the incisions generally reaching the woody layer. The trees are then cut into logs of four to five feet in length and left in dark, secluded parts of the forest. After the third year mushrooms make their appearance in the incised portions. When the growth lessens they are replaced by new logs. The mushroom grows at each season of the year, winter, spring, summer and autumn, but the growth in winter and spring is the result of artificial stimulus. The logs are steeped in water for a number of hours, according to the dryness of locality, and then struck with pommels or axes to prepare the beds for facilitating the growth of the mushrooms. The autumn crop is the most abundant. After being collected, mushrooms are dried either by the sun or by artificial heat.—Journal of the Society of Arts.

A VEHICLE WHEEL TIRE TIGHTENER.

A device which may be readily adjusted to compensate for the expansion or contraction of the wooden fellies of a wheel is illustrated herewith, and has been patented by W. H. Wallingford, of No. 224 South Clinton Street, Chicago, Ill. Fig. 1 represents the application of the improvement, a portion of the felly being broken out, Fig. 2 being a sectional view, and Figs. 3 and 4 representing filling plates and a wedge employed. A metal casing sleeve is employed, in which the ends of the fellies are inserted, there being on the inside of the sleeve an opening closed by a cover plate, and through this opening are inserted two facing blocks each having a transverse rib to be embedded in cross grooves in the end surfaces of the fellies. It is designed that there shall be a slight space or crevice between the blocks, in which the filling plates may be inserted, or from which they may be removed should the fellies

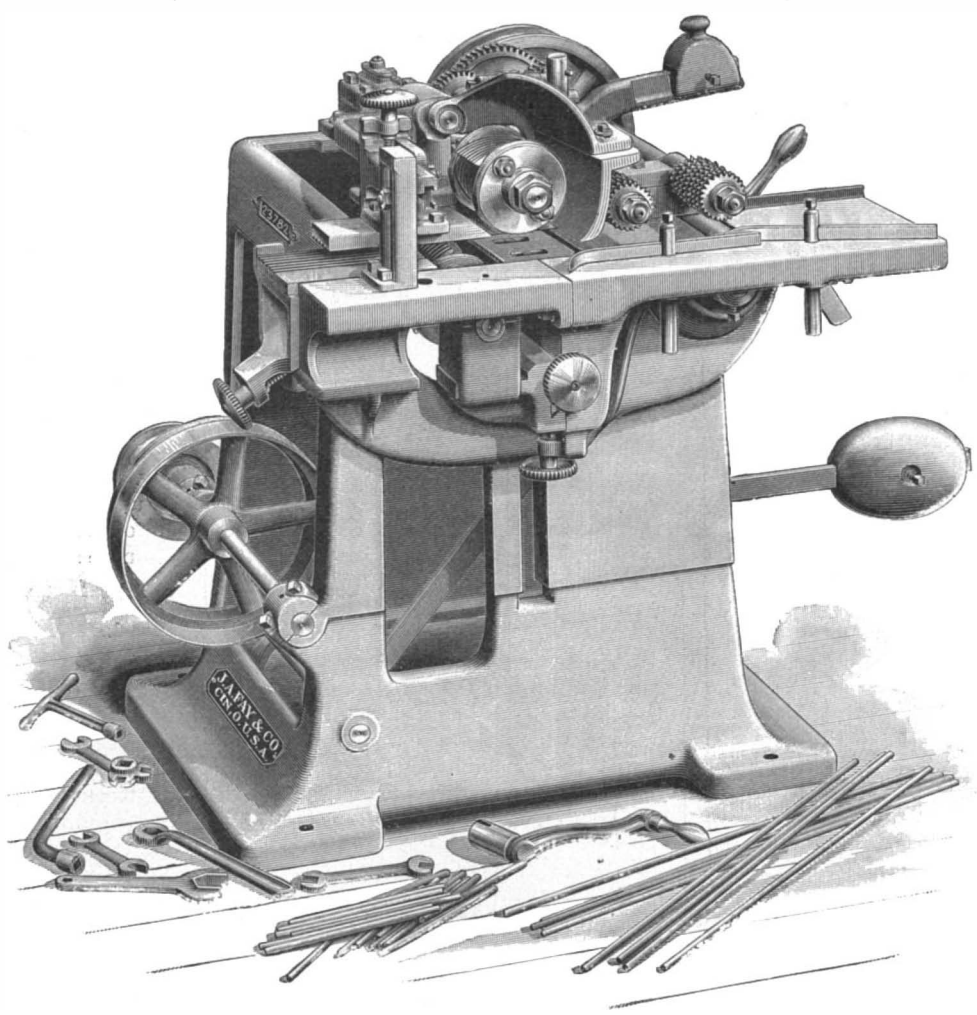


WALLINGFORD'S TIRE TIGHTENER.

become too tightly compressed; and to take up looseness in the joints a pair of wedges is employed to spread apart the facing blocks and the ends of the fellies they are in contact with and thus sufficiently tighten the tire. When the wheel has only a single bent felly but one tightening device can be used, but with a series of sections in the felly a number of tire tighteners are preferable.

Lobsters from the Pacific.

The Kansas City epicures, particularly those who incline to the succulent shell fish, are reveling in the recent introduction of a species of lobster new to this part of the country, says The Kansas City Star. It is known as the Bermuda lobster, and is very unlike the Atlantic lobster, although of the same family. The advent of this new species is very timely, as the Atlantic lobster is growing scarcer and of smaller size and poorer quality with each succeeding season. The Bermuda lobster is gathered on the southern coast of California, and is shipped here from San Diego, Cal., at a cost of five cents a pound less than the Atlantic lobster. In general appearance the Pacific coast lobster, which gets its name because it originated in the Bermuda Islands, where it is now nearly extinct, resembles the ordinary Atlantic species, but a careful examination brings out many little features that are not found in the Atlantic lobster. The Bermudas are considerably larger as a rule than the others, and the boiled ones have a richer red color. The Bermuda has no "shear claw," which is a distinguishing feature of his Atlantic brother, but he has a row of legs or creepers on either side of his body that more than make up for the big "shear claw" of the Atlantic lobster, and he is all meat. The tail part is of the same general character as is that of the Atlantic species, but the flesh is more solid and firmer, and, if anything, the flavor is better than that of the Atlantic species. The Bermuda lobsters have several other points that make them differ from those caught on the Atlantic coasts. They have two long tentacles or feelers that protrude in front of the head a foot or more.



A MACHINE FOR MAKING FLAG STICKS.

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EXPERIMENTS ON THE EFFECT OF VARYING THE AREA OF SCREW PROPELLERS.*

BY PROF. W. F. DURAND, MEMBER OF COUNCIL.

The most extended and undoubtedly the most reliable experiments on propellers of which we have the data were those made by Mr. R. E. Froude, and reported on in 1886.† In these experiments, diameter, speed of advance, and area, both in amount and distribution or shape, were kept constant. The investigation then covered the ground involved in the variation of the other features as noted above, viz., pitch or pitch ratio, and slip or revolutions. The investigation of the influence due to gradual variation in the area was not one of the fundamental purposes of these experiments, and the information relating to this point was restricted to the results arising from a reduction in the number of blades from 4 to 3 or 2, their shape and size remaining the same throughout.

In the experiments to be hereafter described, an additional variable element—that of the amount of area—is to be introduced. In these experiments, therefore, diameter, speed of advance, and shape of blade as well as number of blades are kept constant; while amount of blade area, pitch or pitch ratio, and revolutions or slip, are subject to variation.

The essential feature of the present investigation is therefore the relation of the amount of area to the performance as a whole.

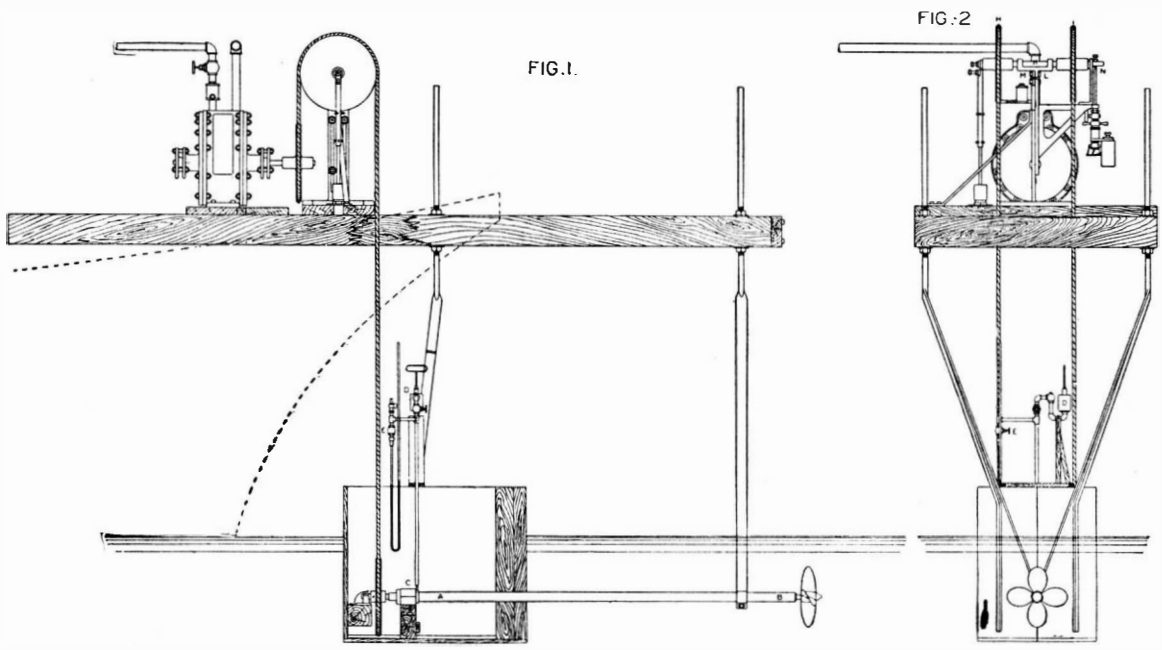
APPARATUS AND MATERIEL.—The experiments here reported were made on propellers of the following dimensions:

Reference No.	Diameter.	Pitch.	Area ratio.	Max. width of blade÷radius.	No. of blades.
2	1′	1′3	0 18	0 2	4
3	"	"	0 27	0·3	"
4	"	"	0·36	0·4	"
5	"	"	0·45	0·5	"
6	"	"	0·54	0·6	"
7	"	"	0·63	0·7	"
8	"	"	0·72	0·8	"

The number of the propeller and its pitch ratio serve to identify it, the number corresponding to maximum width ratio and to area ratio, as seen by comparing the 1st, 4th, and 5th columns.

The elements directly to be measured in any given experiment on one of the propellers are as follows:

The power absorbed, the thrust developed, the revolutions, the speed of advance in undisturbed water.



APPARATUS FOR DETERMINING THE INFLUENCE OF SURFACE ON THE PERFORMANCE OF SCREW PROPELLERS.

The facilities of an experimental tank not being available, it was decided to mount the necessary apparatus on the bow of a small steamboat, the propeller to be tested projecting forward into undisturbed water, and the boat serving as a carriage whereby any desired speed of advance may be obtained.

ARRANGEMENT OF PROPELLER SHAFT AND FITTINGS.—The arrangement of the propeller and shaft is shown in Fig. 1. A B is a pipe surrounding the shaft proper, and provided at its forward end with a ball-bearing. This pipe, at the rear end, passes through the stem of the auxiliary box or false bow, as shown, and is connected with a watertight joint to the forward end of the thrust dynamometer, C. The water has free entrance to the pipe through the forward ball-bearing, and as far aft as the forward end of the dynamometer, C. The shaft proper is coupled to the brass plunger rod of the dynamometer, and the fit between this rod and the dynamometer end is so perfect that no water can leak through.

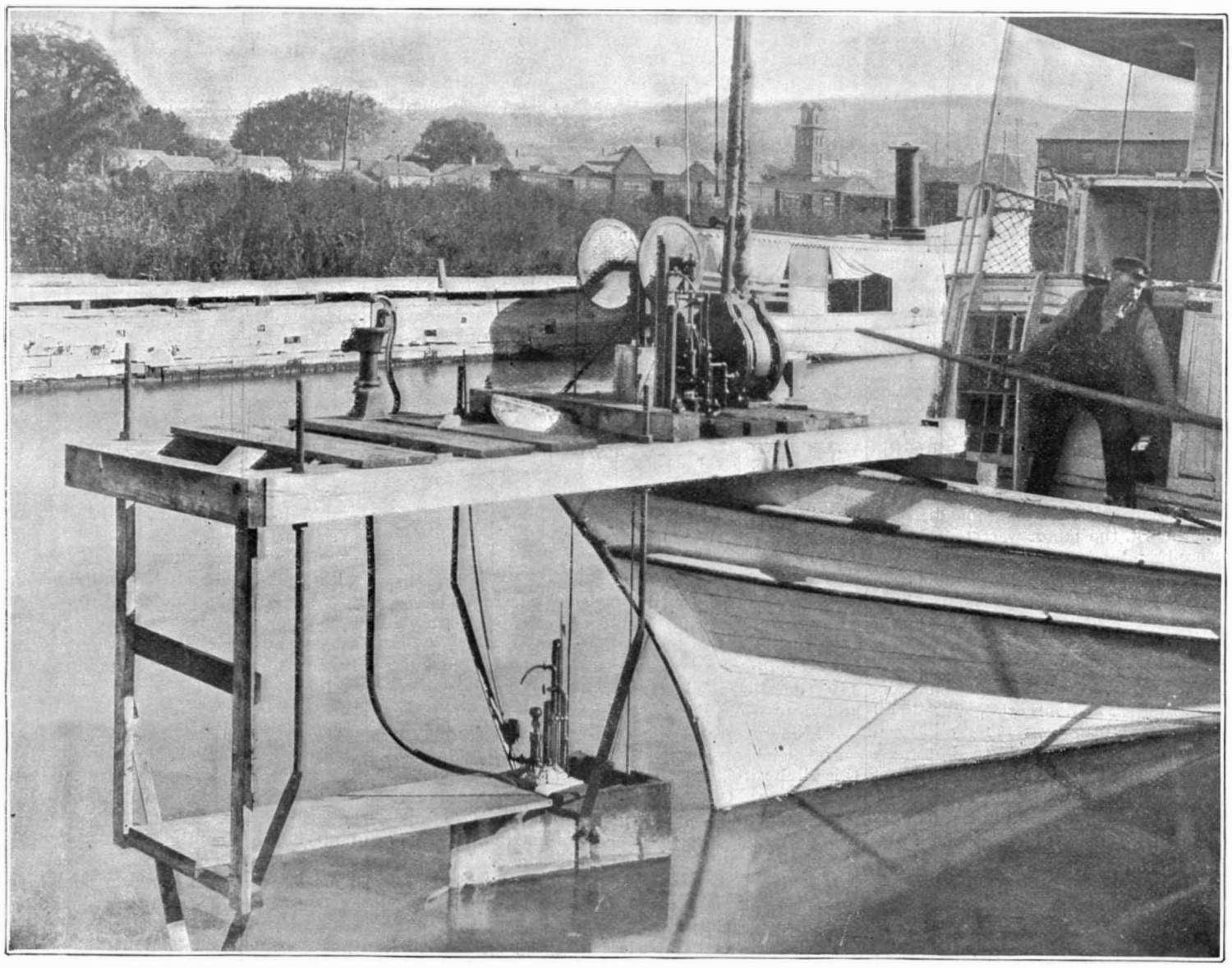
THRUST DYNAMOMETER.—This dynamometer consists of a plunger and oil cylinder. They are accurately fitted by grinding and lapping, with a difference of somewhat less than 0·001 inch in diameter. This difference is sufficient to insure perfect freedom of movement, and the presence of a definite layer of oil between the plunger and the walls of the cylinder. The plunger and rod are in one piece, and the forward end of the latter is coupled to the shaft as noted above. The after end projects to the rear and carries the driving sheave, and is also fitted with a screw for attaching a counting device. This rod passes through a solid bearing at each end of the cylinder, and is fitted by grinding and lapping, as with the plunger. In the forward end of the cylinder is a pipe leading to the mercury gage for measuring the pressure. In the after end is an opening giving free escape for such oil as may leak past the plunger. As indicated above, a small leakage was desired in order to insure complete lubrication of all moving parts, and in use the cylinder thus becomes filled with oil on both sides of the plunger, the slight amount lost being made up by a pump connected with the pressure gage, to be described later.

The propellers are run at a number of revolutions somewhat greater than would correspond to the speed of the boat, thus giving a sternward acceleration to the water acted on, and a forward reaction. This gives rise to a pull on the shaft, and the oil on the forward side of the plunger then furnishes a ready means for the transmission of the pressure to the mercury column, where it is measured. The fundamentally important point of the dynamometer is that, when the plunger is revolving, all longitudinal friction is eliminated, and the delicacy for the measure of the forces involved becomes very great.

The measurement of the pressure is by means of an

* Extract of preliminary paper read at the fifth general meeting of the Society of Naval Architects and Marine Engineers, held in New York, November 11 and 12, 1897.

†Transactions Institute of Naval Architects, vol. xxvii, p. 250.



THE EXPERIMENTAL APPARATUS MOUNTED AT BOW OF STEAM LAUNCH.

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open mercury manometer, as shown in Fig. 1. The stop valve, E, is for the purpose of damping any tendency in the column toward vibration due to periodic fluctuations in the pressure measured. The performance of the thrust dynamometer and pressure manometer was exceedingly satisfactory, and, I believe, leaves little to be desired as to delicacy, accuracy, steadiness, readiness of calibration, and general reliability. The manometer as used in these experiments was not self-registering, but was read by an observer at intervals of a few seconds throughout the run. This gave a very satisfactory value for the mean, but required, of course, the services of an extra observer.

TRANSMISSION DYNAMOMETER. — For the transmission dynamometer the arrangement shown in Figs. 1 and 2 was used, constituting a special form of rope dynamometer. The ropes, F and G, lead from the driving sheave on the after end of the propeller shaft, the former being the tight and the latter the loose side. These pass over sheaves, H and I, and then around the sheave on the motor shaft. These sheaves are all of the same diameter, in the present case 15 inches. The sheaves, H and I, are mounted with ball bearings on a shaft, K, which is carried by a block, L M, the latter being connected to the base by a pair of thin steel plates or springs. This is the well known Emery support or substitute for a knife edge, and for slight movements is almost perfectly frictionless, at the same time affording rigidity in the directions desired.

The sheaves, H and I, and their shaft thus form a balanced rocking system or lever pivoted in the middle, and therefore without deflection so long as the tension on the two sides of the rope is the same. When running, however, the difference between the tensions on the tight and loose sides will determine a moment which will tend to throw this arm down. This motion is prevented by a strut connected with the arm, N, by a spherical joint, and resting on the bottom of an inverted steam engine indicator piston. The compression of the indicator spring is then used to measure the moment, and thence, knowing the revolutions, the power transmitted is immediately known. The indicator drum was given continuous and uniform motion in one direction only, by connecting it through a cord with the main drum of the Weaver recorder.

MOTOR.—For driving the propellers a small rotary engine was used as indicated in the figures. This gave a nearly uniform turning moment and proved itself very satisfactory for the purpose in view.

RECORDS OF REVOLUTIONS, TIME AND DISTANCE.—All records relating to revolutions, time and speed were recorded on a Weaver time and speed recorder, which, it will be remembered, consists essentially of a modified Morse register with a number of pens under electrical control.

THE COURSE.—For the course a distance of 1,000 feet was measured off on a railroad tangent running close to the east shore of Cayuga Lake, where the beach is bluff and deep water extends close to the shore. A similar course was also laid off on a straight reach of the "Inlet," a channel about 100 feet wide leading from the lake to the city. Most of the work was done on the outer course, the Inlet course being used only when the water on the lake was too rough for regular work outside. The observations relating to the ranges were made by an observer holding a circuit breaker in his hand, which was closed opposite each range, thus furnishing ten series of distances of 100 feet each.

THE PROPELLERS are of brass, four bladed as shown, and the blades are of elliptical contour when developed, with maximum widths as shown by the table above. For making the propellers a wooden pattern was first prepared for No. 8. This propeller being cast, the pattern was reduced in blade width and thickness, and No. 7 was next cast, and so on down to No. 2, but one original pattern being thus required for the entire series.

MODE OF CONDUCTING AN EXPERIMENT.—For the determination of a single point or item of the final data two single runs were made, one north and one south.

The boat being brought on the course some distance from the first range mark, the motor was started, and the revolutions were brought by tachometer to the desired point. The speed of the boat at the same time was brought to the constant value, and as the boat neared the range marks the counting and recording mechanism was thrown into operation. The indications of the mercury column on the thrust dynamometer were read and recorded at intervals of a few seconds while on the course. The fluctuations were in all cases slow and gentle, and usually from ten to fifteen readings were sufficient to give a closely accurate average of the indications. In the meantime the range observer closed his circuit on passing each range, and the other records were automatically recorded.

The data thus taken consisted of the following:

An indicator card from the power dynamometer.

A column of readings from the thrust dynamometer.

A strip of paper with dots giving time revolution and range marks.

CALIBRATION.—For the purpose of standardization, the apparatus was erected in the laboratory and operated as nearly as possible under the conditions of use. The power dynamometer was standardized by means of a Prony brake applied on a wheel located on the end of the shaft instead of the propeller. The thrust dynamometer was standardized by applying known thrusts by means of a right angle triangle having a knife edge bearing. The calibrations were made at various speeds and a large amount of data was taken as the basis of these important determinations. The calibration of the power dynamometer was also determined by measurements and the known theory of its action.

REDUCTION OF OBSERVATIONS.--The data obtained as previously described was reduced as follows:

The mean ordinate of the indicator card was determined, and from the calibration data the corresponding power was immediately known. Similarly the mean altitude of the mercury column was determined, and by the calibration data the corresponding thrusts were found. The revolutions per minute, and per 100 feet for the entire course, as well as the speed per minute, were then determined by counting from the strip of tape used in recording the revolutions.

The two sets of results north and south corresponding to a given determination were then averaged and the results thus found were accepted as a series of values of speed revolutions, thrust and power, mutually corresponding the one to the others. This constituted the original reduced data. It became necessary, in order to put the data into form for plotting or investigation, to reduce it to constancy of some one feature. The data was first reduced to constancy of speed, the slip in each case being unchanged.

A correction was also introduced at this point to allow for such slight departures from the standard pitch ratio of 1·3 as existed in the propellers as actually used.

The data was next reduced to constancy of revolution, the slip in each case remaining the same.

DISCUSSION OF RESULTS.—In all cases the slip for zero thrust was specially determined by a set of runs in which, at constant speed, the revolutions were so controlled as to give no thrust. In all cases, except for No. 2, the slip at which this occurs is seen to be negative, and the thrust at zero slip is positive. This result is well known in a general way, but the present experiments, so far as the author is aware, are the first published in which the point has been made the subject of quantitative determination. The explanation of the apparent anomaly is found in the influence due to the thickness of the blade. Independent experiments show, for a body of cross section like a propeller blade near the root, that due to the stream line distribution about such a body, the resultant force, when the direction of relative motion is parallel to the plane face, is directed from the plane face inward, or at least in such a direction as to give a forward component in the case of a propeller thus moving. It is not, therefore, until a negative slip is reached with a more pronounced pressure on the back that this forward component is overcome and a zero thrust obtained. It is also notable that this effect seems to be the less pronounced the narrower the blade, so that for No. 2 a zero thrust was found at nearly zero slip.

The general or average ratios between the thrusts of 2, 3 and 4 bladed propellers given as the result of Froude's experiments are 0·65, 0·865 and 1·00 for areas in the ratios 0·50, 0·75 and 1·00. The corresponding ratios here found for the particular pitch ratio 1·3 with four blades and area ratios 0·18, 0·27 and 0·36, or with areas the same as those for 2, 3 and 4 bladed propellers, are found to vary somewhat with the slip, as shown by the following table:

Slip.	Ratios of Thrusts for Area Ratios.		
	0·18	0·27	0·36
0·10	0·43	0·78	1·00
0·15	0·51	0·80	1·00
0·20	0·56	0·82	1·00
0·25	0·60	0·83	1·00
0·30	0·63	0·85	1·00
0·35	0·65	0·86	1·00
0·40	0·66	0·87	1·00

We come next to the efficiency curves. These are of great interest and highly suggestive. Taking true slips within the usual working range of 0·20 to 0·30, corresponding to apparent slips of, let us say, 0·10 to 0·20, the efficiency increases with the decrease of area, and vice versa. For low values of the true slip, however, the reverse is the case and efficiency increases with the increase of area. For a slip of about 0·20 with this pitch ratio, efficiency seems to be nearly independent of area. Or, viewed from another standpoint, a propeller of small area is comparatively inefficient at low slips, and does not reach its maximum efficiency until a high value of the slip is reached. This maximum value is, however, higher than that reached by propellers of more area. Vice versa, a propeller of large area reaches its maximum efficiency at a lower value of the slip than for less area, and such maximum is less than that for the propeller of the smaller area. Again, the variation of maximum efficiency for variation of area ratio from 0·18 to 0·72 is only about 5 per cent, so that variation of area ratio within this range has comparatively slight influence on the efficiency.

The maximum efficiencies herein determined are slightly less than the value 69 per cent given by Froude for 4 blades and area ratio 0·36. The cause of this difference I am at present unable to explain.

If there be no limit on diameter or revolutions, the conditions likely to give the best efficiency are those of low area ratio and high slip, sufficient size and revolutions being provided, of course, to give the necessary thrust. With electric motors or steam turbines, where the revolutions are naturally high, such a propeller may the more readily be selected, and probably, in such cases, propellers of this character and worked at high values of the slip will be found most efficient.

In conclusion, it may be well to again point out that the data herein contained relates to pitch ratio 1·3, and the conclusions of the present section must be understood strictly as applying to this value of the pitch ratio only.

Electrical News and Notes.

It is stated, says The Medical Record, that telephones are to be placed in the wards of one of the Paris hospitals, within reach of the bedridden patients, so as to enable them to communicate with their friends outside. There will also be an arrangement whereby the telephones may be switched on to a wire connected with a concert hall, so that the performance may be enjoyed by the invalids.

A simple lightning arrester has been employed by Siemens & Halske on an electrical power transmission line leading to the Brussels exhibition. It consists of two rods or bars mounted on insulators and parallel for a portion of their length, where they are close together, while the end portions of the rods diverge, and on account of this shape the device has been termed the "horn" lightning arrester. One of the rods or "horns" is connected to the line or instrument to be protected and the other to the ground.—Revue Industrielle.

A syndicate of New York and Saratoga capitalists has purchased, at a cost of $60,000, the land in the vicinity of Hell Gate Rapids, on the upper Hudson, about seven miles above Glens Falls. The intention is to utilize the great water power at the place for an electrical plant. A dam and power house are to be erected, and with the electricity generated therein a railroad, to be known as the Saratoga Northern, running between Saratoga Springs and South Glens Falls, will be operated. This road will have branches to intermediate places and also to Glens Falls, Sandy Hill and Fort Edward.

The number of periodicals dealing exclusively or largely with electricity amounts to sixty-six. Of these, eighteen are published in France, fourteen in the United States, twelve in Germany, six in England, three in Switzerland, two in Austria, Belgium, Holland, Italy, and Spain, and one in Canada, Japan, and Russia. The oldest electrical paper now in existence is the Annales Télégraphiques, published since 1855 in Paris, France. The second oldest is The Journal of the Telegraph, published since 1868 in Chicago, and the third, the Journal Télégraphique, published since 1869 in Berne, Switzerland.—L'Industrie Electrique.

Budapest, the progressive capital of Hungary, has no longer any horse cars. On December 27, 1897, the transformation of all horse car lines into electric roads was completed. The city has the largest mileage of electric roads of any city in Europe. The total length of the tracks is 119 miles (of which 66 miles are operated by one company); total length operated with underground conductors, 36 miles; number of motor cars, 355; other cars, 58; central stations, 5, with a capacity of 6,500 kilowatts. The entire equipment was completed a full year before the time originally contemplated.—Oesterreichische Monatschrift.

Plans are being made to secure electric power generated by the Housatonic River for the factories of Western Connecticut. James C. Delong, an electrical expert, was in Waterbury several days conferring with local manufacturers, and figuring to what extent the electric power would be used by them. Mr. Delong is the representative of a syndicate of New York capitalists who propose to buy the water privileges of the Housatonic Waterbury Company, which has erected an immense dam across the Housatonic River, about two miles above Shelton, and the big canal that furnishes water power to the Shelton and Birmingham factories. This dam has a fall of twenty-eight feet, and an electric power plant, it is declared, can be erected that could furnish electric power to every factory and electric road in Ansonia, Derby, Shelton, Waterbury, Thomaston, Torrington, Winsted, New Britain, Bristol, Hartford, Berlin, Southington, Meriden and Naugatuck, while if the Naugatuck division of the Consolidated Railroad should be equipped with electricity it could furnish power for that, as well as the Waterbury Traction Company and the other trolley lines of that vicinity. The plans involve an expense of several hundred thousand dollars.

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Correspondence.

Small Electric Motors.

To the Editor of the SCIENTIFIC AMERICAN:

I see by your "Notes and Queries" columns that a great many readers are interested in small electric motors, such as you give instructions for the making of in your paper.

The greatest problem, however, seems to be the economical running of the same with a battery current.

It is time and money thrown away to attempt to use them continuously with a primary battery alone, but by using a storage battery, charging the same from gravity cells, we obtain good results.

As I have had a plant of this kind running almost continuously since January, 1894, my description of the same, giving the original cost and actual expenses per year, will perhaps be of interest to your readers who may wish to install a similar one.

The plant consists of twelve 6×8 gravity cells, placed in the cellar, connected in series, with two No. 14 insulated wires going through the outer cellar wall, then up to the attic and through to the storage battery, the distance being about 50 feet each way, which will make 100 feet of wire. The storage battery is of the chloride type, four cells connected in series, each cell composed of three plates 7¾ × 7¾ inches, placed in a glass jar. To prevent accident I inclosed the glass jars in a lead lined box, using paraffined wood strips on the bottom, around and between the cells.

At first I had the connections inside the box, but soon found that they corroded with the splashing of the acid; so I soldered on rubber covered wires, then covered the joints with rubber cement and rubber strips, bringing them through the box and making all my connections on the outside. This works admirably. Another advantage of having them in a box this way is that it prevents evaporation and it is not necessary to look at them for six months; then, if the acid is below the plates, you can fill over them with a little water. Of course there are the closed rubber storage cells which a person may get, but the cost is a good deal more. By having my storage battery in the attic in this manner, I am able to conduct my working wires to any room on the second floor, using No. 10 wire. If there was any apparatus on the first floor, wires could easily be carried from the charging wires in the cellar up through the floor to the same.

The principal part of the work is to run two sewing machines for family use, one of which is operated by the "Simple Electric Motor," with a cast field and segmental commutator on the shaft. This is inclosed in a box or cabinet on casters, and stands at the right hand side of machine, the shaft being long enough to come through one side and the end of same running in a small hole bored in the iron frame of the sewing machine, between which and the box is a small pulley on the shaft, with a belt running to the pulley of machine. There is a switch placed on the wall to cut off the current when not in use; also a foot switch placed on the treadle and made out of an ordinary window burglar alarm. This leaves both hands free to work with. Three resistance coils, consisting of No. 18 iron wire coiled on brass rods covered with asbestos, are placed inside the motor box, underneath the cover, and connect with a three-point switch on top of the box. When connection is made by the foot, and the switch is not on any of the points, the motor is running in series; and if the storage battery is highly charged, or if the work is light, it will be very satisfactory. Should the work be heavy, however, or the battery low, by switching on the points we allow more current to go through the armature, thereby getting more power.

I have made the "Simple Motor," the "Parkhurst" and the "Hand Dynamo," but the best one seems to be the "Simple Motor;" that is, it seems to have more power for the amount of current passing through.

In another room I have the "Parkhurst" motor running a Singer sewing machine, connected somewhat similarly; only, instead of the motor being in a box, it stands on the table of sewing machine, the resistance being in the base.

I have also a fan which I use occasionally in the hot weather, two small incandescent lamps of four candle power, and an alarm clock which rings a bell and lights a lamp at the same time.

I have had no trouble whatever with the storage battery since first starting. The gravity cells I test about once a month. If they are above 25° Baumé, I take out three glasses of zinc sulphate from each cell, add more blue vitriol if neccessary, clean off the zincs and fill up with soft water.

I have a simple galvanometer in the circuit which I can switch on or off, and from the amount of deflection of the needle can readily tell whether they are charging all right or not. One can cast his own zincs by making a pattern and casting in common fine sand, saving about one-half the cost.

If there are two parties living in one house, one can easily rent out power to the other for say fifty cents per month, or he could run wires across a short distance to his neighbor. I think the plant would furnish enough current for three family sewing machines; that is, to charge continuously, always having the gravity cells connected up. Below I give approximate cost per year for this way. At present I let mine charge till they use up twenty-five pounds of blue vitriol, then I disconnect them from storage battery, take out the zincs, clean and dry them and let them stand till storage battery gets low, then charge up again.

First cost, 4 storage cells at $5.25 each	$21.00
" " 12 gravity cells without zincs	4.20
" " wire, etc.	5.00
" " lead and material for box	4.00
Total	$34.20
Annual expense charging continuously:	
240 pounds blue vitriol at 5½ cents	$13.20
72 pounds zinc at 5 cents	3.60
	16.80
Copper deposit sold	70
Total	$16.10

(This divided between three would only be a little over $5 per year each.)

To charge them as mentioned in latter part of article would be about $10 per year. JOHN DENNIS.

Columbus, Ohio.

Science Notes.

Black rot, the dangerous enemy of grapes, has been treated successfully by sprinkling the green grapes with calcium carbide. M. G. Rodier, a Frenchman, is the discoverer of this remedy.—Revue Industrielle.

For preventing a railroad disaster by the timely discovery of a broken rail and the stopping of an approaching train a locomotive engineer at Halle on the Saale received a reward of 2 marks (50 cents) from the railroad company.

According to The English Electrical Review, it appears that Emperor William of Germany is to decide what system of electric traction shall be adopted at Berlin, and that it is highly probable that this versatile monarch will not select any of the systems, but will invent a new one, provided he has time to do so.

From a series of observations made on tropical plants, H. Molisch states that the freezing of plants at a temperature above 0° C., independently of their transpiration, is the result of chemical rather than of physical changes in the living substance; some chemical processes, such as the formation of chlorophyl and of etiolin, respiration, and the assimilation of carbon dioxide, being largely dependent on temperature, while others are not.—Sitzber. k. Akad. Wiss. Wien.

Two strange tales come from the antipodes. On November 19, the Catholic church at Minyip, Victoria, was partly blown over by a storm, and, propped up by heavy timbers, spiked to the ground. A few days later another storm arose and blew the church plumb on its foundation again. The ship "Nelson" arrived at Wellington, having struck on a rocky point, and had several holes in her bottom. Divers found one hole stopped up by a large piece of rock and another hole calked by a fish that had been squeezed in tail first. These stories are interesting, though we cannot vouch for their authenticity.

In a note recently presented to the Paris Academy of Sciences M. P. Lebeau says that he has succeeded in preparing alloys of glucinum by reducing glucinum oxide in the presence of another oxide or a metal. The most notable of these were alloys of glucinum and copper, obtained by heating in an electric furnace a mixture of glucinum oxide, copper oxide and carbon. The proportion of glucinum varied from 5 to 10 per cent. The alloy of 95 copper and 5 glucinum is yellow in color, and can be forged, is easily worked and takes a high polish. It does not oxidize, says The Engineering and Mining Journal, in the air, but tarnishes slightly under the action of sulphureted hydrogen. Nitric acid dissolves it readily.

Acetylene may be employed for the determination of copper. The salt to be analyzed is dissolved in water mixed with a little ammonia and heated for a short time on the water bath. Acetylene is then introduced into the dark blue fluid to saturation. The precipitate is complete even in the cold. The copper acetylide is now collected, washed and decomposed by being digested with hot dilute nitric acid filtered from the carbonaceous residue and the filtrate evaporated to dryness and ignited. The ash is weighed as CuO. For the separation of zinc and copper, as salts of the former metal are not decomposed by acetylene, the method is most useful.

The Fourth Avenue Trolley Line.

The first underground trolley cars on the Fourth Avenue Line, New York City, to run below Eighth Street, reached the Brooklyn Bridge on March 6. Complete electrical trolley connection has now been established between City Hall and Harlem. The cars are now running at intervals of three minutes during the day, and this will tend to relieve the congested traffic on the parallel lines. The intersection of the tracks of the trolley road and the tracks of the Third Avenue cable road was the most difficult part of the work. The line will soon be completed to the lower end of the Post Office.

Miscellaneous Notes and Receipts.

Paint for Blackboards.—Slate is imitated by the following coat of paint. Boil 5 liters of water in a kettle and add 500 grammes of borax. When this is dissolved add 2 kilogrammes of shellac, stirring constantly, then 1,250 grammes of very fine pumice stone and after some time 500 grammes of lampblack. After all is well mixed, strain the mixture through a fine brass sieve and cool off.—Färben Zeitung.

Conversion of Mineral Oil into Candle Material.—A. Dousson has patented in Russia a method for solidifying mineral oils for use in candle making by mixing with them about 1 per cent of nut oil or mutton tallow in the warm, and when the temperature has attained 150° C. or thereabout, adding 4 per cent of (27°) soda lye, well stirred in to keep the mass from frothing up, and also to prevent the constituents from separating when cooled. At 200 C. the whole should again become liquid and be then transferred to a second vessel, where it is distilled by steam. The lighter portions of the oil are thus driven off, and the solid residue is employed for moulding into candles. This process has been tested by J. A. A. Runjanz, who found, however, that by following the directions given, not more than 8 per cent of the initial quantities taken remain as residue, and even this portion is semifluid and altogether unsuitable for casting into moulds. Even if it could be moulded, it seems probable that the percentage of ash would be too great to allow the material to be of any use for the purpose of illumination.—Trudy. Bak. Otd. Imp. Russk.

Slate Marble.—Belgium exports a sort of black marble which is nothing else than prepared slate. According to the statement of an expert, such black marble can be prepared in the following manner: The slate suitable for this purpose is first polished nice and smooth with a sandstone, so that no visible impression is made on it with the chisel; this is the rough polish. After this polish finely with artificial pumice stone and finally finish with extremely light natural pumice stone. The polished surface now presents a velvet-like, soft appearance. Allow to dry and heat the surface thoroughly, whereupon the finely polished surface is impregnated with a heated mixture of oil and fine lampblack. This is allowed to remain for twelve hours. According to whether the slate used is more or less gray, the process is repeated until it loses its gray appearance. Now polish thoroughly with emery, which is taken on a linen rag, and finally finish polishing with tin ashes to which is added some lampblack. After the polishing is finished spread wax dissolved in turpentine, to which some lampblack is also added, on the polished plate warmed again. It is allowed to remain some time and then rubbed off vigorously with a clean linen rag. The slate thus treated now has a deep black appearance and looks like black marble. The polish is just as durable as the latter. The polished surfaces can be etched, engraved, gilded and silvered, just the same as genuine marble.—Bautechnische Zeitschrift.

Foreign Competition in England.

The question of foreign competition as affecting the United Kingdom was dwelt upon by Sir J. Wolfe Barry, the president of the Institution of Civil Engineers, in distributing the prizes at a London trades training school recently. He said that instead of the rails for many of the Indian railways being supplied from Great Britain, as they had previously been ever since railways were constructed, they were now coming from America. In spite of the enormous distance these rails were carried, they were being delivered in India at lower prices than British manufacturers could touch. Again, he knew perfectly well that in London an enormous amount of machinery was now being brought from America at lower prices than English manufacturers could quote. Locomotives, which also used to be supplied by Great Britain, not only for India but for the colonies and foreign countries, were likewise being sent out from continental workshops. Touching on the disputes between capital and labor, he argued for a more accurate view of the former, which he said was too often regarded as consisting of money alone, whereas it represented the power of direction and the ability to study the markets of the world and to know what could be sold and what could not.—Bradstreet's.

Important Decision in Regard to Trade Marks Used in England.

The use, upon articles put on the market in the United Kingdom of Great Britain and Ireland, of a trade mark with the notice "Trade mark registered" is prohibited by law if the trade mark is not actually upon the register in Great Britain at the time the articles are offered for sale. American manufacturers using trade marks in connection with goods to be sold in England will therefore either have to register their trade marks there or, failing in this, they should omit from the goods or labels all reference to the trade mark being registered. In many cases this will necessitate the printing of special labels for the English market.

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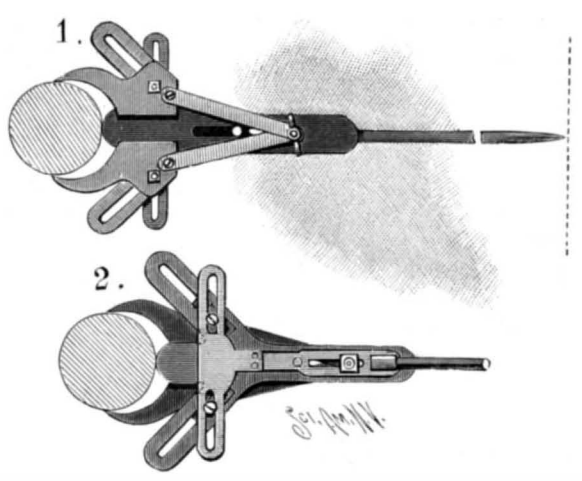
IMPROVED CALIPERS.

To facilitate the proper aligning of shafts in a line of shafting, the calipers shown in the accompanying illustration have been devised and patented by Fred A. Thompson, of Eureka, Wis. Fig. 1 is a plan view showing the use of the device with the shaft in section, the calipers indicating the distance from the center of the shaft to an auxiliary guide line, and Fig. 2 is an inverted plan view. The device comprises a main frame provided with angular guide arms, the frame having a rest adapted to be seated on the surface of the shaft, caliper arms being fitted to slide on the angular guide arms, and a block being held to slide on the frame; links connect the block with the caliper arms, to bring their points in contact with the surface of the shaft at opposite points and at right angles to a radius at the point of contact of the rest with the shaft. After the desired adjustment is made the several parts are locked in place by screwing up the clamping screw. The frame is provided with a graduation, not shown, reading the diameter of the shaft on which the calipers are placed, and is read by a pointer or mark from the guide block, to indicate the distance from the center of the shaft to the guide line.



THOMPSON'S CALIPERS.

SPANISH DESTROYERS AND TORPEDO BOATS DESTINED FOR CUBA.

We present an illustration which will be of special interest in view of our present critical relations with Spain. It represents several of the destroyers, torpedo boats and torpedo gunboats which are destined for service in Cuban waters.

The first division, which includes the torpedo boat destroyers "Pluton," "Terror" and "Furor," and the torpedo boats "Rayo," "Halcon," and "Azor," is under the command of Fernando Villaamil. The second division will consist of the torpedo boat destroyers "Osado," "Audaz" and "Proserpina" (which are about completed by the builders at Glasgow) and the torpedo boats "Ariete," "Habana" and "Barcelo."

These boats are the pick of the Spanish torpedo flotilla. They represent the very latest developments in torpedo boat design, and one of them, the "Ariete," was at one time the most notable vessel of its kind in the world. This little craft is a torpedo boat proper as distinguished from the later destroyers. She was built to the order of the Spanish government in 1887, by Thornycroft, of London, and on her trial trip broke all existing records by maintaining a speed of 26·1 knots per hour. This was considered phenomenal at the time, and remained for several years the record speed for a steam vessel; indeed, it was not until such large vessels as the "Havock" and "Hornet" made their appearance in 1893 that her performance was surpassed. The "Ariete" is 147½ feet long and of 97 tons displacement. She has 1,600 horse power and carries an armament of four 3-pounder rapid-fire guns. She is provided with two torpedo tubes. The "Rayo" is a sister boat to the "Ariete," was also built by Thornycroft, but is credited with half a knot less speed.

Of the other torpedo boats, the "Azor" and the "Halcon" are larger boats of 108 tons. They have the same horse power but two knots less speed. Their armament is the same, but they carry an additional torpedo tube. These boats were built by Yarrow, of London, in 1887. The "Habana" was built by Thornycroft, in 1887. She is a small boat of 59 tons displacement, has two torpedo tubes and has 21·3 knots speed. The "Barcelo" was built by Normand, well known as the inventor of the boiler which bears his name and by the successful torpedo craft which he has turned out. She is of 66 tons displacement and 19½ knots speed and carries two torpedo discharges. All of these boats are designated as first class and are comparable in speed and equipment with similar boats in other navies.

The strength of this flotilla, of course, lies in its brand new destroyers. The destroyer is an enlarged torpedo boat provided with sufficient size and power to enable it to keep the sea with a fighting fleet—something that the torpedo boat cannot do. In the course of the English naval maneuvers it was soon discovered that the high speed of the torpedo boat was strictly a fair weather speed, and naval constructors realized that greater weight, size and power were necessary to render these little craft serviceable anywhere outside of sheltered waters. At the same time the enormous increase in the torpedo boat flotillas of other European navies necessitated some defensive action against them, and it was resolved to build a fleet of vessels of from 300 to 400 tons displacement, armed with powerful guns, which would be capable of running down and destroying torpedo craft. Hence the name "destroyers."

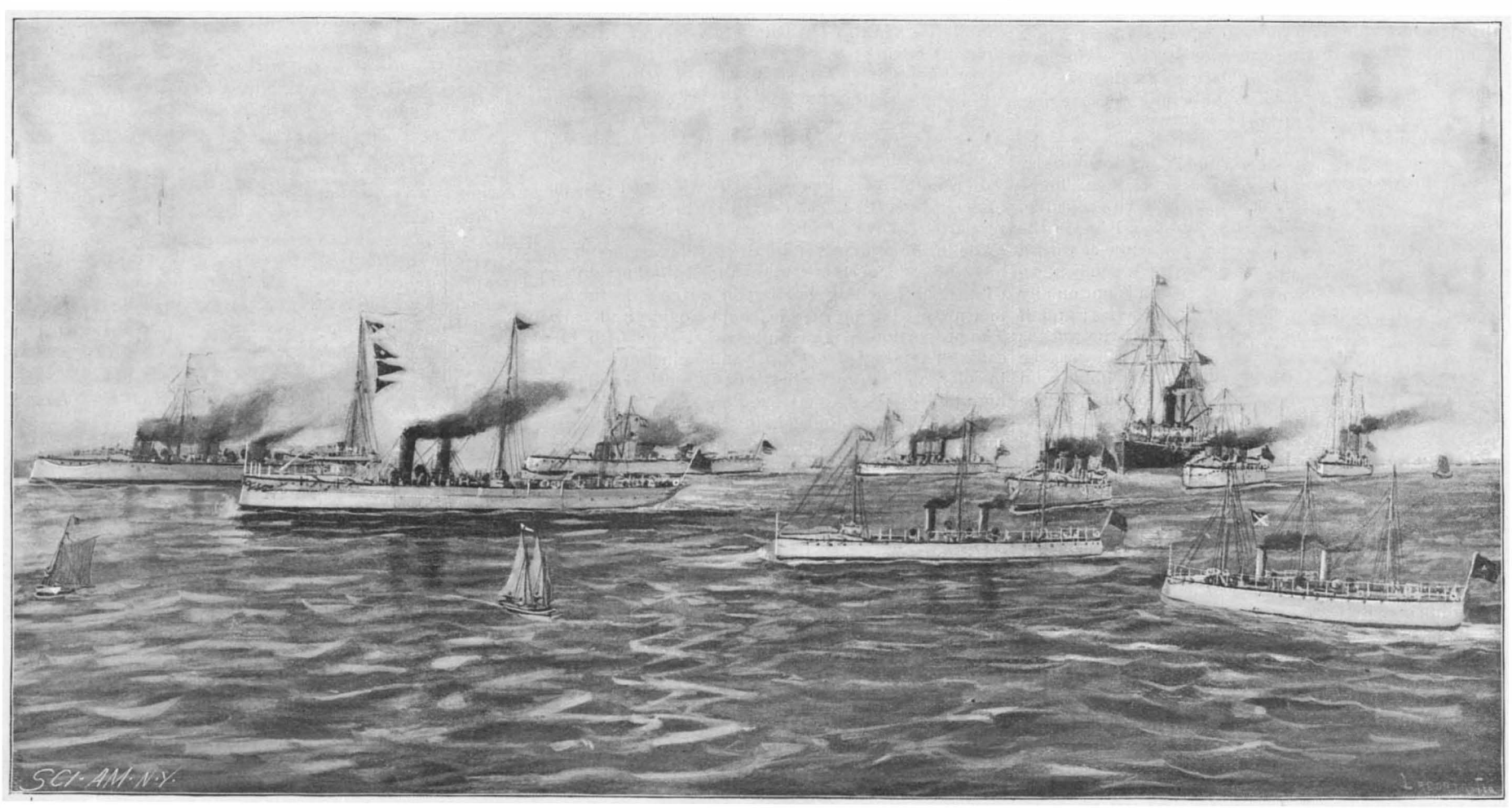
Of the three which are in active service, the "Furor" and "Terror" were launched in 1896. They are 220 feet long, 22 feet beam and 5½ feet draught, with a displacement of 380 tons and a speed of 28 knots. They have twin engines of 6,000 horse power and bunker capacity for 100 tons of coal. There are two torpedo tubes and the complement of men is 67. The armament is heavy—too heavy according to the ideas of our own designers—consisting of two 12-pounder rapid fire guns, two 6-pounders and two 1-pounders. The 12-pounder fires a 3-inch shell weighing 12 pounds with a velocity of 2,200 feet a second, which is capable of penetrating 8 inches of iron at the muzzle; so that it can be seen that one of these boats could annihilate a torpedo boat as soon as it had run up within range.

Of the other four destroyers, one, the "Pluton," is already in service, and the other three, the "Audaz," the "Osado" and the "Proserpina," will sail at an early date. The "Pluton" was illustrated in the SCIENTIFIC AMERICAN of December 25, 1897. These four are identical in all respects and they have the characteristic of being considerably the largest destroyers in the world, being of over 100 tons greater displacement than the latest English boats of this type. Their speed, however, is not so great by 2 knots. The particulars are as follows: Length, 225 feet; beam, 22½ feet; draught, 5·8 feet; displacement, 400 tons; speed, 30 knots; horse power, 7,500; coal capacity, 100 tons; and complement of men, 70. They carry two torpedo discharges and their armament is identical with that of the "Furor" class.

In bringing these boats over the Atlantic everything will be done to guard against accident and disablement in heavy weather, especially in the case of the smaller boats. The guns will be unshipped to reduce top weight and provide additional coal carrying capacity for the long journey.

The larger vessels shown in the cut are the "Destructor" and the "Transatlantico." The former is a torpedo gunboat of 458 tons displacement; 3,800 horse power and 22½ knots speed. She is armed with three 5-inch guns, four 6-pounders and four machine guns, and she carries three torpedo tubes. The Spanish navy is strong in this class of vessel, a large number of gunboats of from 500 to 800 tons having been built for service in the Cuban and Philippine waters.

Our illustration is reproduced from La Ilustracion Española y Americana.



SPANISH TORPEDO FLEET DESTINED FOR CUBA.

The Current Supplement.

The current SUPPLEMENT, No. 1159, contains many papers of more than usual interest. "Tests of the Synchronograph on the Telegraph Lines of the British Government" is an important paper which supplements the series begun in SUPPLEMENTS No. 1114 and 1115. It is profusely illustrated with maps and diagrams. The "Diesel Heat Motor" is an important paper dealing at considerable length with the interesting motor shown in last week's SCIENTIFIC AMERICAN. The battleship "O'Higgins," which, according to rumor, has been purchased by Spain, is illustrated and described. "The Russian Petroleum Industry" describes the production of refined petroleum on the Caspian Sea. The article is ably written and is profusely illustrated. There is also an excellent formula for papier maché, which is so often desired by our readers. For a full table of contents see page 178.

THERE were 31,110 students matriculated at German universities the past winter semester, an increase of 1,000 over last year. The largest increase is, as usual, in the law faculty.

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THE MANUFACTURE OF PAPER.

I.—THE PREPARATION OF WOOD PULP BY THE SULPHITE PROCESS.

If one were asked to name the three staple articles of manufacture which are most essential to modern civilization as exemplified in the average work-a-day citizen, he would mention in their order food, clothing and paper, the first two as being essential to the physical and the last to the mental and, in a large degree, the moral well-being of the race. History shows, moreover, that as man has gradually struggled upward from his primitive and crude condition, there has been a contemporaneous and successive appreciation of these necessities of life, and the measure of demand for one of them, at least, has been a fairly good test of the degree of civilization in the later ages of the world's history.

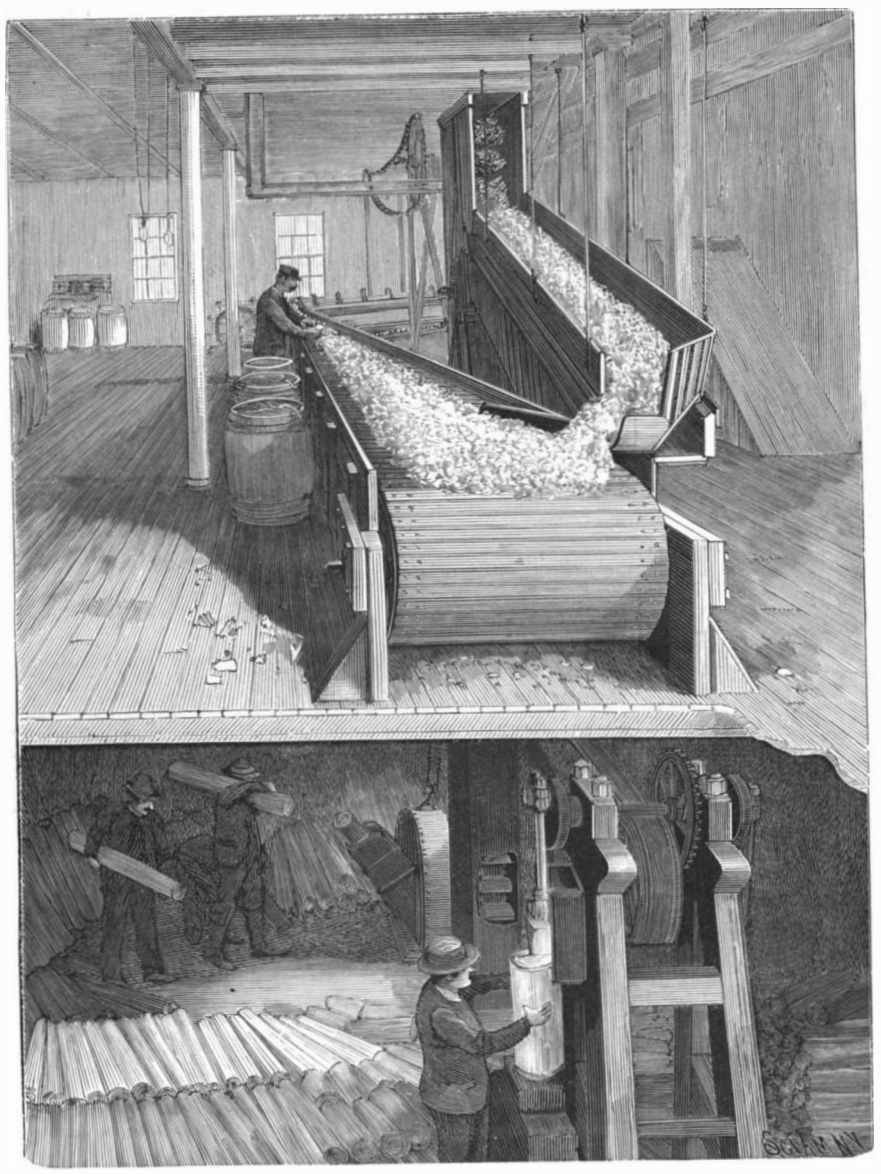
It seems like the statement of a mere truism to say that the consumption of paper by a people is the measure of their intellectual advancement; for it is a well understood fact that the countries in which education is most widely spread, where the average intelligence is highest, and the desire for knowledge and information is keenest, show the greatest consumption of paper per capita. It is a curious fact, however, that while most people have more or less knowledge of the processes by which wheat is manufactured into bread, or wool and cotton into a suit of clothes, there is probably not one in a thousand who has any conception of the ingenious processes by which the rough trunk of the forest tree is transformed into the finished sheet of paper upon which he reads the news of the day.

Outside of those who are concerned in the paper trade, either as manufacturers or wholesale purchasers and consumers, it is probable that there are few people who have any clear knowledge either of the nature of the raw materials from which the bulk of the paper is made or of the truly enormous capacity of the mills which are devoted to its manufacture.

In the whole United States there are to-day over 1,000 mills at work, whose united daily capacity amounts to over 13,000 tons of paper in twenty-four hours. Of the total amount of paper produced—which, of course, falls somewhat short of this figure—by far the larger part is manufactured from wood, and not, as was formerly the case and as is even now popularly supposed, from rags.

The paper mills of the Duncan Company, which we have selected for description, are situated on the banks of the Hudson River at Mechanicsville, about twelve miles north of the city of Troy, N. Y. Here a massive stone dam 850 feet in length with a fall of 16 feet has been constructed, and the energy of the impounded waters is developed in twenty turbines whose aggregate horse power is 3,500. This is supplemented by a steam engine plant of 750 horse power. On approaching the mills, which cover a rectangular block on the bank of the river 980 feet in length by 354 feet in width, one passes through a vast yard of spruce and poplar cord wood, in which, at certain seasons of the year, as many as 20,000 cords may be seen stored at one time. Most of this wood, which averages 9 inches in diameter by 4 feet in length, is cut in the Adirondacks and the forests of Canada and brought to the mill by rail and canal. Seventy-five cords of poplar and forty-five cords of spruce are consumed by the mills each day, which, after it has passed through the various processes and taken up the clay, starch, alum, resin, size, etc., which are used, is shipped from the mill as finished paper or chemical fiber—40 tons of the former and 34 tons of the latter per day.

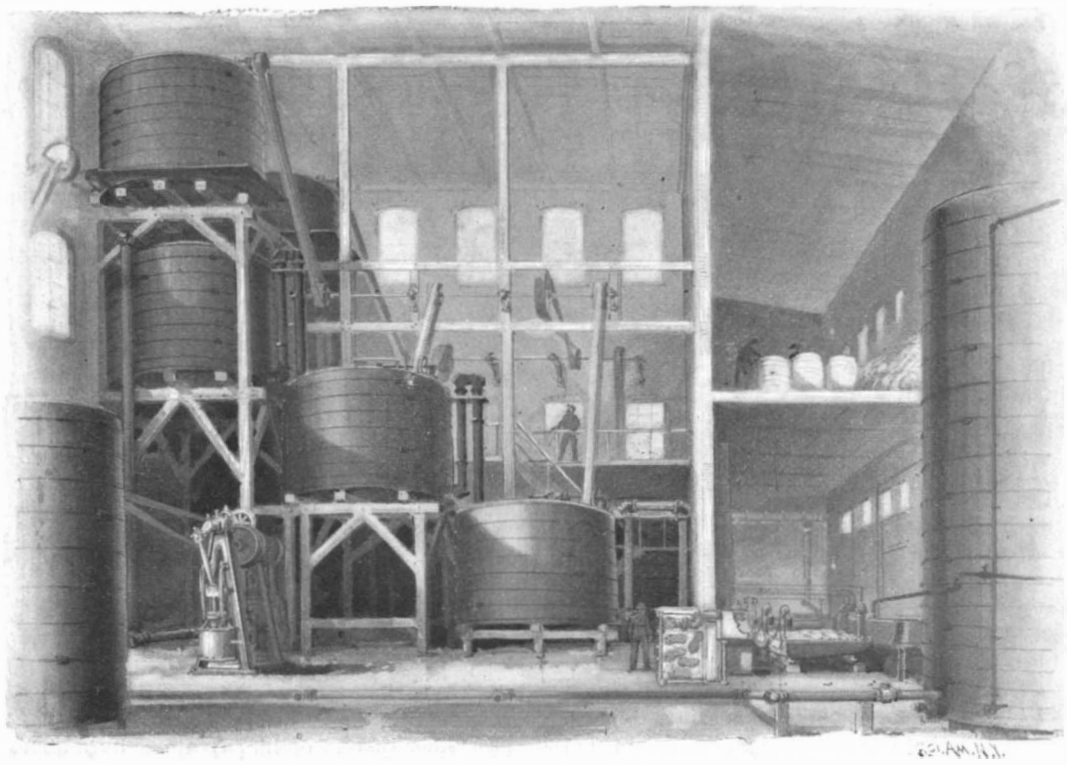
All paper is made from one or more of the various vegetable fibrous substances, such as cotton, flax, straw or wood; and if a piece of paper, particularly of the finer grades, is examined beneath the microscope it will be found to consist of a mass of fibers which are roughly interlaced and present something of the appearance of fine woven textile goods. If we similarly examine a section of wood, we find that it consists of parallel fibers which are cemented together by cellular matter, and it is this fibrous material which is used in the manufacture of the wood pulp, as it is called, from which the paper is made. The preparation of the fiber by the destruction of the cellular matter is accomplished by digesting the wood in chemical solutions; the spruce being treated with sulphurous acid and the poplar with caustic soda. The pure fiber which remains is then taken to the paper mill and worked up into paper.



2.—CONVERSION OF LOGS INTO CHIPS.

THE SULPHITE MILL.

Our illustration, Fig. 2, shows the preparation of the "chips." The spruce logs, should they be too large, are first split to the proper size in the splitter, whose operation is explained by the cut, and they are then placed endwise in the spout of the chipper, where they bear by their own weight at an angle of thirty degrees against the face of a swiftly revolving disk, in which are four knives set in radial slots cut through the disk. Each knife cuts off a diagonal chip from the log, the thickness of the chips, or what is the same thing, the length of the fiber, being from ⅝ to ¾ inch. The disk runs at 300 revolutions a minute and it can eat up 100 cords of wood in a day of 10 hours. The chips now fall onto a conveyor and are taken to the second story of the building, from which they are fed into an inclined oscillating screen, where the sawdust and dirt are removed, finally discharging onto a traveling sorting table, 50 feet in length, as shown in Fig. 2. Here a set of men carefully pick out all the slivers and larger knots together with the long strips which are occasionally torn off the logs by the chipper. At the end of the table the chips are discharged onto an inclined conveyor, which carries them to a large storage bin above the sulphite digester, which is capable of holding 100 cords of chips at a time.



3.—PREPARATION OF SULPHITE PULP—THE SULPHUROUS ACID PLANT.

The sulphurous acid for treating the chips in the digester is prepared by burning sulphur and drawing the fumes through a series of tanks containing a solution of milk of lime. Ohio white lime containing about 45 per cent of magnesia is used in preparing the solution, for the reason that salts of magnesia are soluble in hot water, whereas calcium salts are not and would form a troublesome scale in the digester. The acid plant, which is in duplicate, is shown in Fig. 3. The sulphur is burned in the retorts shown in the room adjoining the tank room, and the fumes are led through a coil of cooling pipes and then passed in succession through a series of large tanks filled with a solution of lime water. After passing the coil the gas enters the bottom of the lowest tank of the series and rises through the solution, where much of it is absorbed. What is not absorbed collects above the liquid and is led to the bottom of the second tank, the process being again repeated in the third tank of the series. The operation is assisted by a vacuum pump, which maintains a partial vacuum above the liquid in the last tank. The pure milk of lime solution is fed from the top tank of all, and the acid solution at the proper strength is drawn off from the lowest tank and stored in large receivers ready for use in the digesters.

The digester, Fig. 1, is a huge cylindrical steel plate structure, 38 feet long and 15 feet in diameter. The shell is one inch in thickness and it is built with butt joints, the rivets being countersunk on the inside, so as to secure a smooth surface for the lead lining. The latter, $\frac{5}{16}$ inch thickness, is laid close against the shell and is seamless throughout. The digester is closed at both ends with covers of cast steel protected with linings of ½ inch of lead. The shell is further protected from the acid by a thick lining of a special grade of brick. For convenience of erection and repairs the digester, which weighs 125 tons, is hung on trunnions, whose journals may be carried on two pairs of massive lattice girders, by means of long six-inch rods with screwed ends depending from the top of the columns. While it is in operation, the digester rests upon six ten-inch cast iron columns; but when it is desired to make repairs, it can be raised by means of the screws from the columns, swung into the horizontal position (the slight brick filling of the arches in the side walls of the building being taken out), and lowered onto rollers on the floor.

The digester is filled to the top with chips from the bin overhead, and the acid is then piped in by an overhead pipe which leads from the large storage tanks, whose capacity is 60,000 gallons. The cover is then bolted on and steam at 80 pounds pressure is introduced at the bottom. The heating of the lower layers of liquid causes a continual circulation throughout the mass during the whole period of cooking, which varies from nine to twelve hours. During the cooking, the acid solution attacks and renders soluble the incrustating matter of the wood—resin, lignose, cellular matter—and dissolves it out, leaving only the pure fiber of the

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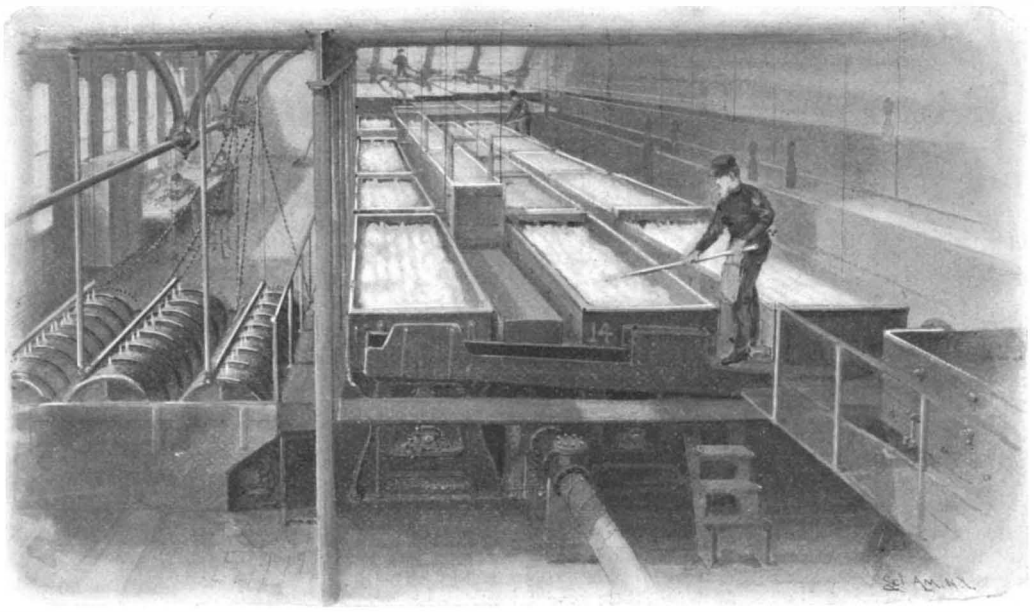
wood. The acid solution has a weak chemical affinity, and gas is liberated on a slight rise of temperature. The sulphur gas rises and escapes by the pipe which (Fig. 1) will be noticed leading from the throat of the digester to a trap in the corner of the upper room. From the trap it is led through the acid storage tank and condensed, adding its strength to the liquor.

When the cooking is completed, a ten-inch blow-off valve is opened and the contents are driven out into the "blow pit," a large wooden tank furnished with a perforated false bottom. The steam escapes through a four-foot vertical stack and the spent liquor, containing the dissolved resinous and cellular matter of the wood, drains off and goes to waste. The pulp at this stage has a beautifully transparent appearance, due to the bleaching effect of the sulphurous gas. When the spent liquor has strained off, the "pulp," as it is now called, is taken to the wash pits, where it is thoroughly washed with pure water. From the wash pits it is pumped up to a mixing box in which it is mixed with a sufficient amount of water to give it the proper fluidity, and is then run into the screen room shown in Fig. 4. Here it passes through a threefold system of screens for the removal of foreign bodies or such particles as would produce blemishes in the paper. It first passes through the coarse screens, located at the far end of the room, which have a one-eighth inch mesh and serve to take out the coarse knots and any uncooked fiber. It then flows into a settling box, where any particles of lime or dirt are removed by gravity, and finally passes onto and flows through the "fine screens."



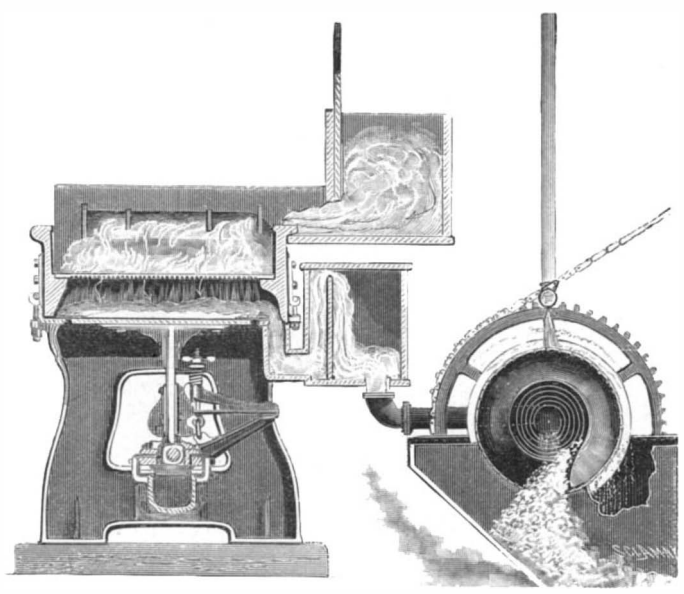
4.—THE FINE SCREENS FOR REMOVING TOO COARSE MATERIAL FROM THE PULP.

The general arrangement of the latter is shown in the figure referred to, and a cross section of these screens and copper straining cylinders is given in Fig. 5. The fluid pulp flows from the settling tanks into troughs which open by means of side gates onto the screens, of which there are four in each row. Each screen consists of a shallow box open at the top and provided midway of its depth with a horizontal screen consisting of a brass plate perforated with innumerable fine slits $\frac{15}{1000}$ in width. The bottom of the box is attached to the sides by flexible rubber gaskets, and it is kept in continual and rapid vertical oscillation by means of cams mounted on a revolving shaft beneath the screen, which acts on a shaft projecting from the bottom of the screen box. This vibration produces a bellows-like effect and draws the fine pulp down through the screen, leaving the coarser material behind.

The pulp now flows into the copper cylinders. These are about 3 feet in diameter and 15 feet long. The outer shell is freely perforated and the interior is traversed by a sheet copper worm whose outer edge is riveted to the outer shell and its inner edge is in contact with the hollow axial shaft upon which the cylinder rotates. The pulp flows into the cylinder at one end, and as it is guided through by the worm the water drains away, leaving the moist pulp, which now looks something like half melted snow, to fall out at the other end of the cylinder. Jets of water are playing continually upon the outside of the cylinder for the double purpose of keeping the perforation from being choked up by the pulp and washing the fiber. From the copper cylinders the pulp falls onto a conveyor which takes it through the "bleaching engine."

Paper made from sulphite pulp at this stage of the process would be apt to fade and turn yellow. To prevent this it is bleached by subjecting it to the action of chlorine for a period of three hours, in what is known as the bleaching engine. This is a large iron tank, open at the top and provided with semicircular ends, half way across which is placed a revolving drum provided with transverse bars. The pulp is placed in this tank together with a solution of chlorine and a little oil of vitriol to hasten the bleaching. Steam is introduced and the drum or agitator is set in motion. The latter works in the fluid contents of the tank much as a deeply immersed paddle wheel would in water, loosening up the pulp and causing a thorough contact with the bleaching liquor. The pulp is emptied into "drainers" in the cellar of the building, where the liquor is allowed to drain away. The pulp is then thoroughly washed with fresh water and again drained. When it is nearly dry, it is dug and sent in cars to the paper mill.

The process as described, from the time the pulp leaves the fine screens, is applicable only to such sulphite pulp as the Duncan Company manufacture directly into paper themselves. In our next article we shall describe the manufacture of soda pulp and show how that portion of the pulp, both sulphite and soda, which is supplied to the open market is prepared for shipment to other paper mills.



5.—SECTION THROUGH THE FINE SCREENS AND COPPER CYLINDERS.

Simonides, the Forger of Manuscripts.

Prof. Max Müller says that Simonides, the celebrated forger of Greek manuscripts, was certainly a most extraordinary man—a scholar who, if he had applied his ingenuity to editing instead of forging, might have held a very high position. His greatest achievement was, of course, the newly discovered Greek text of the history of ancient Egypt by Uranios. The man possessed a large quantity of later Greek MSS. It seems that in the eastern monasteries, where he sold, he also acquired some Greek MSS., by what means we must not ask. He tried several of these MSS. with chemicals, to see whether, as was the fashion during the middle ages, the parchment on which they were written had been used before, and the old writing scraped off in order to get writing material for some legends of Christian saints or rather modern compositions. When that has been the case, chemical appliances bring out the old writing very clearly, and he knew that in this way some very old and valuable Greek texts had been recovered. In that case the old uncial writing comes out generally in a dark blue, and becomes legible, as underlying the modern Greek text.

As Simonides was not lucky enough to discover or recover an ancient Greek text, or what is called a palimpsest MS., the thought struck him that he might manufacture such a treasure, which would have sold at a very high price. But even this did not satisfy his ambition. He might have taken the text of the Gospels and written it between the lines of one of his modern Greek MSS., adding some startling various readings. In that case detection would have seemed much more difficult. But he soared higher. He knew that a man of the name of Uranios had written a history of Egypt, which was lost. Simonides made up his mind to write himself in ancient Greek a history of Egypt such as he thought Uranios might have written. And, deep and clever as he was, he chose Bunsen's "Egypt" and Lepsius' "Chronology" as his authorities. After he had finished his Greek text, he wrote it in dark blue ink and in ancient uncial Greek letters between the letters of a Greek MS. of about 1200 A. D. Anybody who knows the smallness of the letters in such a MS. can appreciate the enormous labor it must have been to insert, as it were, beneath and between these minute lines of each letter the supposed earlier writings of Uranios, so that the blue ink should never encroach on the small but true Greek letters. One single mistake would have been fatal, and such is the knowledge which antiquaries now possess of the exact changes of Greek letters in every century that here, too, one single mistake in the outline of the old uncial letters would have betrayed the forger.

When Simonides had finished his masterpiece, he boldly offered it to the highest tribunal, the Royal Berlin Academy. The best chemists of the time examined it microscopically, and could find no flaw. Lepsius, the great Egyptologist, went through the whole text, and declared that the book could not be a forgery, because no one except Uranios could have known the names of the ancient Egyptian kings and the right dates of the various dynasties, which were exactly such as he had settled them in his books. The thought that Simonides might have consulted these very books never entered anybody's mind. Great was the excitement in the camp of the Egyptologists, and, though the price demanded by Simonides was shamefully extravagant, Bunsen persuaded the then King of Prussia, Frederick William IV., to pay it and to secure the treasure for Berlin. Dindorf, the famous Greek scholar, had been intrusted by Simonides with the editing of the text, and he had chosen the Clarendon Press at Oxford to publish the first specimen of it. In the mean time, unfavorable reports of Simonides reached the German newspapers, and during a new examination of the MS. some irregularities were detected in the shape of the uncial M, and at last one passage was discovered by a very strong microscope where the blue ink had run across the letters of the modern Greek text. No doubt could then remain that the whole MS. was a forgery.

Simonides was forced to refund the money and was sent to prison, never to reappear again in the libraries of Europe. But, Prof. Müller tells us, he succeeded in palming off a number of his forgeries upon public and private collections in England, among them portraits of the Virgin Mary, some of the Apostles painted by Luke (!), and a copy of Homer, with a dedication from Pericles to the Tyrant of Syracuse. Even after his forgery of Uranios was exposed, he received an offer of £100 for it as a curiosity, but refused the offer.—We are indebted to The Home Journal for the above particulars.

International Congress of Applied Chemistry.

We are informed by Dr. W. H. Wiley, of the Department of Agriculture, that the Second International Congress of Applied Chemistry will be held in Vienna in July, 1898. Nearly 2,000 members were present at the last meeting, and it required five large volumes to contain the report of its proceedings. A committee has been appointed to promote the interests of the Congress in this country, and it is hoped many chemists will be induced to attend. It is expected that arrangements can be made by which substantial reductions can be obtained in the transportation to Vienna. The opportunity of meeting distinguished chemists from all parts of the world will doubtless be appreciated by the American members. The scientific work of the Congress will be conducted in twelve sections. Excursions to localities of interest will be arranged for and will be announced at a later period. Papers in German, French and English will be accepted, and authors are requested to communicate with the chairmen of the various sections and send them titles of the papers and subjects which they would like to have discussed. Further information may be obtained by addressing Dr. W. H. Wiley at Washington, D. C.

WORK on the Jungfrau railway is progressing satisfactorily. The Lauterbrunnen River furnishes 2,400 horse power used for the electric rock drills. The bed of the river has been changed for a distance of about six miles. The line is practically complete to the Eiger glacier, and this section will be opened for traffic in June. Work has also been begun on the main tunnel and more than 150 yards have been completed; the solid rock has been found at 30 yards under the snow, instead of 70 yards, as first expected.—Cosmos.

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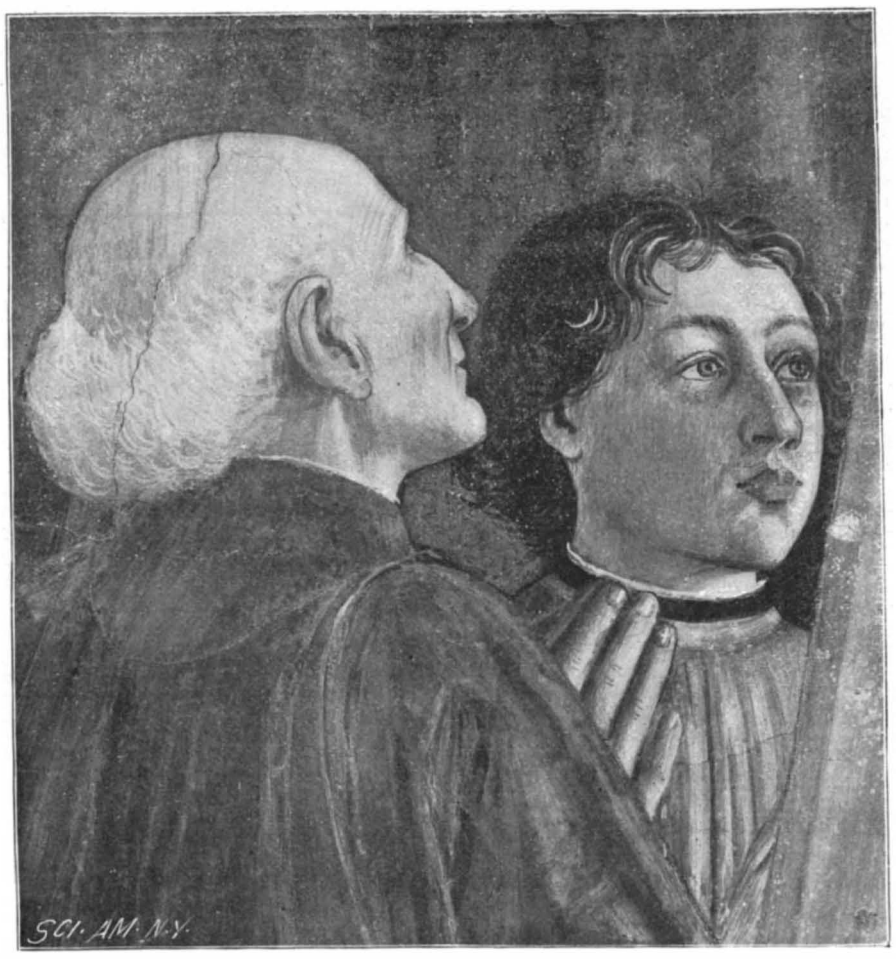
A NEWLY DISCOVERED PORTRAIT OF AMERIGO VESPUCCI.

A discovery has just been made in Florence which is of the greatest importance from an historical point of view. There has been no artistic sensation in Florence of late years, with the possible exception of the finding of Botticelli's "Pallas" in 1895, which can be compared with the discovery on February 3 of a portrait of Amerigo Vespucci in an altar piece by Ghirlandajo in the Ognissanti Church at Florence. We are enabled to present probably the first photographic reproduction of this portrait which has appeared in this country, the negatives having just been made by the Fratelli Alinari, of Florence. Special attention has recently been paid to Vespucci, owing to the approaching celebration of the four hundredth anniversary of his alleged voyage.

That Domenico Ghirlandajo painted a fresco for the Vespucci family has long been known. Vasari says: "Over an arch in the same chapel there is a *Misericordia* wherein Domenico (Ghirlandajo) has protrayed the likeness of Amerigo Vespucci, who sailed to the Indies" (*che fece le navigazioni dell' Indie*). Bocchi, in his guide book to Florence (*Le Bellezze della Città di Fiorenza*, 1591), says: "In an arch in which is painted a '*Misericordia*' by the hand of Domenico there is likewise the portrait of Amerigo Vespucci." The painting was never lost in the strict acceptation of the word, for we have the testiomy of Vasari and Bocchi that it existed, and we know that the Vespucci chapel was whitewashed in 1616, but some time ago the walls of this chapel were scraped and no fresco was found. It now seems, however, that there were two Vespucci chapels in the Ognissanti Church and that the better known of these in 1616 passed to another family, when the walls were whitewashed. It is nothing unusual for families to have two chapels in a single church, as, for example, the two Strozzi chapels in Santa Maria Novella in Florence, but the existence of two such chapels is apt to make confusion in documents, so that it is, therefore, not surprising that the mistake occurred.

The picture was looked for in other parts of the church, but the investigators were misled by Vasari's words "over an arch," while in reality it was under an arch. Padre R. Razzoli, of the Franciscan Order of *Minori Osservanti* and historian of the Ognissanti, informed Signor Guido Carocci, the inspector of monuments, that he had found in some old documents in his convent the statement that there were frescoes under certain pictures in the chapel of St. Elizabeth, Queen of Portugal.

On February 3, Matteo Rosselli's canvas of St. Elizabeth was removed and behind it was found the long lost Ghirlandajo. It seems that one of the altars in the chapel was set up by the Vespucci family. Like so many altar pieces it is in two parts, the lower representing the dead Christ and in the curved *lunette* under the arch is a standing figure of the Virgin Mary, the Lady of Mercy, "*Misericordia*," whose ample mantle, supported by angels, surrounds the members of the Vespucci family, while with her outstretched arms she pronounces a benediction on the kneeling figures. She stands on a dais on which are the words "*Misericordia Domini plena est terra.*" Six women kneel on her left and six men on her right. Kneeling next the Virgin among the latter is the figure of a young man who presents a three-quarter face view. This head has been identified as that of Amerigo Vespucci, from whom we derive our name of "America," and it is marked by such intelligence that it seems to presage his future greatness. Next him is the head of Amerigo the Elder, grandfather of the navigator. The ecclesiastic is an uncle of Amerigo and was a friend of Savonarola. The rest of the figures are believed to be members of the Vespucci family. The mother of Amerigo is the central figure on the other side. The figures are about two-thirds life size. There is nothing strange in the introduction of family portraits in altar pieces. It was the universal custom at that time to include the members of one's own family as taking part, usually as spectators, in representations of great scenes of the Christian faith. It has been suggested that the dead Christ in the lower part of the fresco is the work of Davide Ghirlandajo, the brother of Domenico, as it is not so well executed as the *lunette*.



AMERIGO VESPUCCI IN GHIRLANDAJO'S RECENTLY DISCOVERED FRESCO.

The authenticity of the portrait seems to be settled beyond doubt. We know that Amerigo was born in 1452 (O. S.), for his certificate of baptism has just been discovered in the register of the church of San Giovanni. It reads: "*Lunedi a di 18 Mars 1452, Amerigho et Matteo, di Messere Nastagio, di Messere Amerigho Vespucci, popolo Se Lucia Ognissanti.*" "Monday, March 18, 1452, Amerigo and Matteo, of M. Nastagio, of M. Amerigo Vespucci, parish of Santa Lucia, Ognissanti." This seems to show that Amerigo was a twin. It is generally believed that the fresco was painted about 1472, as it was known to be one of Ghirlandajo's early works. This would make Amerigo Vespucci about twenty years of age. His grandfather's tombstone was found a few years ago. It bears the date 1472, and the figure in the fresco is undoubtedly a portrait from life of his ancestor, so this would seem to bring the date of the fresco within very narrow limits, and as all the other men are older than Amerigo Vespucci, it is reasonable to suppose that the young man in the fresco is a true and authentic portrait of the navigator.

The fresco is well preserved, and to all appearances has never been retouched, and the artistic value of the discovery is very great, as it gives us an arch-authentic Ghirlandajo in a fine state of preservation.

Domenico di Tommaso di Currado Bigordi, called Ghirlandajo, was born in 1449 and died in 1494. He is important among the Florentines of the last quarter of the fifteenth century, on account of the human quality of his splendid portraits. Sobriety runs through all his work. There is no exaggerated movement, and the calm Florentine burghers sit quietly for their portraits. He was never so much at home as when painting assemblages of grave people, and he seizes the personality of his sitters and makes them live. The question of his contribution to the art of the Renaissance is well summed up in the Blashfield-Hopkins "Vasari," which says: "His grave and virile style becomes the link between Masaccio in the beginning and Raphael at the culmination of the art of painting. To the student of the Renaissance, of Florentine history, or of the 'human document,' Ghirlandajo's portraits of the contemporaries of the magnificent Lorenzo and of Savonarola are invaluable; the old town still lives in these frescoes, and though the master was not given 'the walls of Florence to paint,' as he desired, he portrayed the world within those walls."

The history of Amerigo Vespucci is well known. Born in 1451 at Florence, he died at Seville in 1512. He was a son of a notary of Florence and became a clerk in the commercial house of the Medici. He was sent to Spain by his employers about 1490, and some years after became a member of the commercial house at Seville which fitted out Columbus' second expedition. Amerigo Vespucci claimed to have accompanied four expeditions to the new world, concerning each of which he wrote a narrative.

THE RECENTLY DISCOVERED FRESCO OF THE VESPUCCI FAMILY.

The first expedition, in which he would appear to have held the position of astronomer, left Cadiz May 10 to 20, 1497, and after stopping at the Canary Islands came "at the end of twenty-seven days upon a coast which we thought to be that of a continent." If this expedition is authentic, Amerigo Vespucci reached the continent before either the Cabots or Columbus. He wrote an account of his various expeditions and also letters to Soderini, the Gonfaloniere of Florence. One of these letters was published in 1507 and Waldseemüller made use of this letter in the same year and was the first to suggest the name of "America." The sole authority for a voyage made by Vespucci in 1497 is the word of the navigator himself, and historians have proved that from the middle of May, 1497, to the end of May, 1498, Vespucci was busily engaged at Seville and San Lucar in the equipment of a fleet on which Columbus sailed on his third voyage. This seems to prove conclusively that Vespucci was not absent from Spain at the time the alleged voyage occurred. Contemporary history is silent regarding it.

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RECENTLY PATENTED INVENTIONS.

Agricultural.

MOWING MACHINE.—William O. McGee and Charles L. Downing, Gallatin, Mo. In this machine the gearing is reduced to a minimum, the machine having but comparatively few parts, and being light and strong while yet designed to be highly effective. It has a forward drop frame carrying a cutter bar with elongated eye, and a sickle shaft having an eccentric working in the eye of the cutter bar, there being beveled gearing between one end of the transverse shaft and the sickle shaft, while a pinion on the other end of the transverse shaft meshes with a driving gear on the axle, there being a shifting lever connected with a pivoted foot lever conveniently reached from the driver's seat

CORN PLANTER.—James K. Patterson, Crete, Neb. An automatic dropping means for corn planters is provided by this invention, comprising an auxiliary frame hinged to the rear frame of the planter and carrying a shaft rotated by a wheel which rests upon the ground when the frame is dropped to horizontal position, but which clears the ground when the frame is raised. Contact arms fixed upon this shaft and on a longitudinal shaft coact to reciprocate a dropping mechanism, the distance between the hills being determined by the diameter of the wheel which contacts with the ground when the frame is dropped and by the number of the arms.

FERTILIZER DISTRIBUTER.—Walter T. Johnstone, Macon, Ga. To more effectively distribute guano and other fertilizers upon the soil, this invention provides a new agitating device for stirring the fertilizer while the machine is in motion, the agitator having propulsion blades designed to pulverize the material so that it will be distributed upon the ground in a loose or separated condition. One of the blades of the agitator wheel, when the machine is in motion, pushes the guano over the discharge opening of the hopper, and the next blade pushes the guano in the opposite direction, thus insuring an even and positive feed, the machine being readily adjustable to limit the amount of fertilizer to be distributed.

MARKER FOR PLANTERS.—Reuben I. Brundage, Cairo, Neb. This invention provides an attachment for planters which can be shifted from side to side and brought into action at either side of the machine with two motions, its adjustment being effected without stopping the team and without the driver dismounting. The marker is of simple construction and readily adjustable, and may be raised to clear an obstruction while the planter is in motion, and dropped immediately after passing the obstruction.

Bicycles, Etc.

BICYCLE BRAKE.—Elmer E Robison, Ainger, O. This brake is applied by holding back on the pedals, or back pedaling, there being fixed to the end of the crank hanger adjacent to the pedal crank a circular disk having an outwardly bent annular flange, with which brake shoes are brought into engagement by the toggle action of links actuated from the pedal crank when back pressure is exerted upon the pedals, springs moving the brake shoes out of contact with the flange when the back pressure is relaxed.

SKIRT GUARD. — Caroline E. Miller, Minneapolis, Minn. This is a device designed to be arranged upon a bicycle to protect the skirt of a female rider from the wind. It comprises a wire frame adapted to be secured to the front brace of the bicycle frame and extend laterally at each side, the frame having a cover consisting of two sections, one of which has a flap below the frame at the center. and is designed to lap over and button to the adjacent portion of the other section. The shape of the frame is such that it is not likely to bend under the wind pressure, and the cover may be of any suitable light material, as rubber gauze or similar fabric.

Mechanical.

GANG PUNCH.—Levi Fisher, Brantford, Canada. To facilitate the ready adjustment of punches and dies according to the work in hand, and locking them in position to insure proper punching, this invention provides a punch stock fitted in a head. and adapted to carry a pressure pin engaged by the punch and a coupling screwing on the punch stock for pressing the pin in engagement with the head, as well as for clamping the punch stock in place on the head. Longitudinally split dieholders are arranged to receive and hold the dies, being fitted loosely in a groove formed in the base block while a pressure bar fitted in the groove engages with its inner beveled edge the forward faces of the dieholders. With this improvement a wide variety of work may be done without special and separate attachments.

EYELET PUNCHING MACHINE.—Thomas A. Perrins. Ansonia, Conn. In this machine a stripper plate is employed having holes for the cutting punches and openings fitting the eyelets to be cut, with sections of its under surface before and after the section containing the punch holes raised or offset from the perforated sections, while there are presser plates beneath the raised parts of the stripper. The sheet is fed to the punching press with the barrels of the eyelets up, instead of down as heretofore, this being designed to produce a smoother and handsomer eyelet, while the quality of the product is not affected by the size of the eyelet, a small eyelet being as readily and perfectly produced as a larger one.

Miscellaneous.

HORSE RACING.—James F. Harding, Port Deposit, Md. A convenient and readily adjustable means for quickly affixing the race track number for horses to the sleeve or shoulder of the jockey riding each horse is provided by this invention, the device being in charge of and attended to by each jockey instead of necessitating the attention of the judges, etc., with the attendant delay. It consists of a frame or holder, to be attached to the seam of the coat at the shoulder by a hook and a rubber band, the frame holding a series of numbered disks, and having an opening through which the number on any exposed disk may be plainly seen, the arrangement being such that the rider can readily change the disks to present to view the desired number.

ELEVATOR SAFETY STOP.—Eugene X. Genoud, Newark, N. J. To stop an elevator in case of the breakage of the suspending cable, according to this invention, racks are fixed at the sides of the elevator well, and levers pivoted on the cage carry gear wheels adapted when the levers are swung outward to engage the racks, springs acting to make firm such engagement of the wheels, and there being a restraining connection between the wheels and the elevator supporting mechanism.

WATCH PROTECTOR.—Benjamin Greenberg, Boston, Mass. To securely hold a watch in its pocket so that it cannot be removed by a straight pull upon the watch or chain, but only by a special action on the holder, this inventor has patented a device comprising two opposing plates which embrace the watch, their bottom edges connected by a spring and one of the plates having a flange on its upper edge, with a notch accommodating the watch stem, while on the other plate are pins adapted to engage a garment pocket. To free the watch, a thumb or finger must be used to partially open the plate casing.

CAN HANDLING DEVICE.—Asmus Jensen, Louisville, Ky. To facilitate moving cans, jars, buckets, etc., from high shelves or other places out of convenient reach, this invention provides a pole with end bracket on which tongs are pivotally mounted, a link being pivotally connected to each shank of the tongs and with a pull rod extending to the other end of the pole, where it is adapted to be engaged by a rack.

CURTAIN STRETCHER.—James J. Oliver, Brooklyn, N. Y. To facilitate the stretching of window curtains or other draperies, in drying or for other purposes, this invention provides a stretching frame having side rails and a bottom rail, each side rail having an attached guide plate, while beads are secured to the bottom rail, yokes being attached to the beads and embracing the guide plates, and thumb screws carried by the beads engaging the guide plates to hold the parts rigidly.

SUPPORT FOR CURTAIN POLES, ETC.—John Kroder and Henry Reubel, New York City. This support consists of knobs adapted to be screwed into the window casing, one end of the pole or rod fitting snugly into a recess in one of the knobs, while the other knob has an elongated recess formed by two bores, into which the other end of the pole or rod may be passed, being locked in position by turning the support into proper position, although the pole or rod may be readily removed when it is desired to remove or replace the curtains.

SHUTTER FASTENER.—John C. Steelman, Linwood, N. J. This is a simple device for securely holding a shutter in open position, consisting of a bracket to which is pivoted a forked keeper having an apertured extension in which is a lug, there being also a lug on the inner portion of its body and a latch pivoted to the bracket in rear of the keeper. To release the shutter, one simply swings the catch upward. The device is inexpensive and does not mar the lower edge of the shutter.

SMOKE, SOOT AND SPARK DESTROYER.—George J. Terrell, Meriden, Conn. According to this invention, the chimney proper is closed at its upper end, from which a pipe leads to the lower portion of an auxiliary chimney, a circulating fan being arranged in such pipe, while a stand pipe in the auxiliary chimney connects with a suitable water supply and is furnished with spray nozzles, from which the water is directed downwardly and laterally in jets to cover the entire transverse area of the auxiliary chimney, thus wholly destroying the smoke, soot and sparks.

GARMENT DRAUGHTING PATTERN.—Marie Tucek, New York City. To facilitate the convenient and accurate draughting of ladies' seamless waists and skirts, with but a single seam in the body, this invention provides a waist pattern having an angular base on which is adjustably held a waist arm pivotally connected with a slide held adjustably on the base, a front arm being held adjustably on the slide, and there being an arm scye having two adjustable members, one adjustable on the slide and connected by links with the front arm, while the other scye member is connected with the shoulder measuring device connected with the back arm held adjustably on the base. The necessary graduations are arranged on all the adjustable parts.

SASH LOCK.—George A. Stedman, New York City. This invention provides improvements in locks to be attached to the upper rail of the lower sash and the upper surface of the lower rail of the upper sash to prevent the opening of the window. Attached to each sash is a plate having upwardly projecting arms which are sloping on their opposite sides, a link engaging each of these sides to prevent the moving of the sash from the outside. The device adjusts itself to considerable variation in the height of the sashes, from shrinkage or other cause.

OPENER FOR ENVELOPES OR WRAPPERS.—Frank E. Munn, New York City. According to this invention, the envelope is made with a small wire located almost wholly within and a small portion only visible on the outside of the envelope, a length of wire extending along the edge inside the flap, with its ends bent over and almost entirely covered, but with a small portion exposed, by taking hold of which one edge of the envelope may be torn open. The same principle is applied as a wrapper fastening, the wire being placed mainly between the wrapper and the material inclosed.

FLOWER JAR. — Stephen D. Engle, Hazleton, Pa. This jar is made of porous material, and with a cavity for the reception of water, the jar being so formed as to permit the roots and earth to be laid and held around its outer surface, thus presenting the appearance of a solid mass of earth and plants or a solid ball of vegetation. The roots and earth are held in position by wires, for fastening which projections are formed in the upper edges of the neck and in a socket at the bottom.

Designs.

PAIL.—Ellen J. Joy, Stoops, Pa. This pail is larger at the top than at the bottom, and is designed for use in scrubbing and cleaning, etc., having in one side a fluted panel, like a washboard, on which the mop or scrubbing cloth may be rubbed.

BICYCLE BAGGAGE CARRIER.—A. J. Gilfillan and W. H. White, Eureka Manufacturing Company, Nyack, N. Y. This carrier is a neat and inexpensive device readily attached by a set screw to the rear of the saddle support, and has tapering arms extending in opposite directions, on which a bag, satchel or other article may be conveniently carried and be entirely out of the way.

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Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7376) C. S. asks for an explanation of the theory of how the variations in the pressure of the atmosphere affect the salts contained in what is known as the chemical barometer. A. The chemical barometer usually contains a substance which readily absorbs moisture from the air. Calcium chloride is often used. This grows heavier when damp and lighter when dry. If cobalt chloride is dissolved in alcohol and applied to paper or any other surface, it is blue or rose color when warm and dry and pink when moist. These changes are produced by moisture, and not by the pressure of the air. You will find these instruments described in Hopkins' "Experimental Science," price $4 by mail.

(7377) W. G. W. asks: What causes the stretching force on the rubber cord of a return ball when swung about the hand—centrifugal or centripetal? A. It is the so-called centrifugal force, which is the amount of force necessary to bend the ball from a straight path at right angles to the cord at any moment into the circular or other curve in which the cord compels it to move.

(7378) R W. M. asks for a receipt for something that will render wood battery cells acidproof. A. Mix together equal parts by weight of guttapercha and paraffine. Melt them both over a water bath, melting the gutta percha first. Have the wood dry and warm and coat the cells evenly with the heated composition. It may be smoothed with a hot iron.

(7379) W. A. M. asks: 1. What is meant by referring to an incandescent lamp as consuming ½ ampere of current? Is the consumption on the basis of ½ ampere per hour? A. A current flow of ½ ampere is necessary to bring the filament of a lamp to full incandescence. We speak of a current of 1 ampere as we would speak of a stream of water flowing in a channel 1 foot wide and 1 foot deep. This has no direct relation either to time or quantity of water. The quantity of water that will flow past a point in this channel is determined by the velocity of the stream and by the time during which it flows; so the quantity of electricity that shall flow through a conductor which is carrying 1 ampere depends on its pressure (volts) and upon the time. This quantity is reckoned in coulombs. A coulomb is the quantity which flows in 1 second when the current is 1 ampere, and the current will be of 1 ampere when the pressure is 1 volt and the resistance 1 ohm. The basis of charging for electric current used is the ampere hour, which is a current of 1 ampere flowing for 1 hour. 2. In regard to fuse wire, if a branch cut-out or other such device is fused to carry say 10 amperes, how should each side of the cut-out be provided—with 5 ampere fuses or 10 amperes on each side, as in the case of a double pole cut-out? A. With 10 ampere fuses, since the same 10 amperes which flows out on one side flows back again on the other after it has done its work. 3. Is it practical to fit armature core disks direct to the armature shaft with key and not insulate them from the shaft? A. Yes; that is the present mode of construction. 4. I had a 2 horse power shunt wound motor in service driving cut-off saw, when suddenly, after I had been using saw several days previous to this occurrence, the belt slipped off pulley on motor. Motor was stopped by me quickly, but when I attempted to start again in the usual way, the armature would not revolve as freely as before; in fact, it would stick on a certain side when this side would pass a certain point on the pole pieces, and we have never been able to use motor since. Since we found no short circuits or burned out coils in armature or fields, we are at a loss to understand this action and would thank you for an explanation to this, and also the other questions. A. It would seem as if the shaft were bent so as to bind at one side.

(7380) A. W. B. asks: 1. How long will plunge battery (as described on page 401, "Experimental Science") last if used about six hours a week to run motor ⅛ horse power? A. The duration of the plates in a plunge battery depends on the thickness of the zinc. $\frac{5}{16}$ inch is a good thickness. These should last six months at least. The carbons never wear out. The liquid would require renewal each week. 2. Will not round stone jars answer as well for cells? A. The advantage of a square or rectangular jar is in the compactness of the battery. If that is of no consequence, any other form is just as good. 3. Would like to find out the cost to keep and maintain said battery. A. The cost depends only on the price of sodium bichromate, sulphuric acid, mercury for amalgamation and zinc at your place. This we do not know.

(7381) F. A. S. asks: 1. What size wire should the magnets of a relay that are about 1 inch long be wound with to work on a line of No. 12 galvanized iron wire ½ mile long, with ground return and some 200 feet of No. 18 office wire in the same circuit? A. Wind the relay magnets with No. 30 silk covered copper wire. It is hardly necessary to use a relay and local battery to work a sounder on a line only ½ mile long. The main battery at the ends of the line should be sufficient. 2. How many 6×8 Crowfoot batteries should it require to work the line with no other instruments cut in? A. Not more than six cells—three at each end of the line.

NEW BOOKS, ETC.

THE PSYCHICAL CORRELATION OF RELIGIOUS EMOTION AND SEXUAL DESIRE. By James Weir, Jr., M.D. Louisville. 1897. Pp. 338. 12mo. Price $2.

"The author of this monograph has been incited to its publication by the commendations of three of the most eminent critics and editors of magazines in the United States, to whom it was submitted in manuscript. In this essay he discusses his subject from a physio-psychical standpoint, and believes that he has kept intact the canons of scientific investigation, observation and discussion."—Extract from preface.

THE HOUSE WARMING MANUAL. Containing essays on steam heating, hot water heating, warm air heating. Arranged for publication by Sidney P. Johnston. Second edition. Chicago: The American Artisan Press. 1898. Pp. 270. 8vo.

Articles on steam heating, hot water and warm air heating, are included in this work. The heating engineer can find no field so fruitful of results as the study of current practice of the brightest of our practical heating men. The articles in this volume have been carefully selected from those submitted in The American Artisan House Warming competition from all sections of the country. These cannot but prove a valuable aid to those interested in this great and constantly widening field of technical endeavor. The book is illustrated with floor plans and elaborate estimates.

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INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

MARCH 8, 1898,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Absorber, W. M. Mixer	600,159
Actinometer, G. F. Wynne	600,484
Adjustable folding, reading, and work table, J. A. Hanger	600,148
Air compressing machine, P. Cramer	600,258
Air compressor, F. M. Graham (reissue)	11,654
Alarm. See Gage alarm.	
Aluminum, purification of, P. E. Placet	600,268
Amalgam washing apparatus, H. C. F. Stormer	600,211
Animal trap, J. M. Mast	600,156
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Awning attachment, J. J. Price	600,270
Awning frame, N. C. Decker	600,306
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